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RENEWAL OF ORDER MANAGEMENT AND INVOICING PROCESSES IN A GLOBAL PROJECT-BASED FIRM

Master of Science Thesis

Examiner: prof. Miia Martinsuo
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ABSTRACT

JULIA ROITTO: Renewal of order management and invoicing processes in a global project-based firm
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Order management and invoicing is an important part of order fulfillment process. This is because customer order is recognized as one of the main ways to transfer information between functions and organizations within a supply chain. In order to manage the orders and invoicing efficiently, organization must know special requirements of all order types. The objective of this study is to introduce all different order management and invoicing processes in a global project-based firm and present various ways to improve the processes. The knowledge about these processes helps in their harmonization into standardized operating procedures, improves data and reporting quality for decision making and eases employees work by storing tacit knowledge and updating ways of working. The renewal of processes is made to overcome current challenges in the processes and to serve the customers better.

This thesis was conducted as a single case study in a global project-based firm that develops and delivers automation systems, products and services to pulp, paper and energy industries. The qualitative data was collected by interviewing 12 order processors and by observing the work of project order management and invoicing team. The data analysis was performed by drawing process graphs, comparing different order types in a summary table and generalizing differences into general process. The scope of the research was in order types that occur in global business-to-business sales in a project-based firm.

Based on the current state analysis, a project-based firm can have truly diverse and varying order management and invoicing processes depending on the order type. For instance, the target company has 19 different order types and 10 various order management and invoicing processes. These processes cannot be merged together, but all of them include four phases (receiving, entering, invoicing and closing) from which order entry is the most significant one. The main challenges a global project-based firm faces in order management and invoicing relate to the complexity and variety of different global orders. This thesis provides a road map for the target company to address these challenges with suggestions for improvement relating to enterprise resource management systems but also beyond it. The organization can improve its processes by re-categorizing order types, standardizing processes and centralizing order management and invoicing tasks, and by improving the coordination with functions. In addition, the company should provide new and updated instructions that match also the conducted improvements.

TIIVISTELMÄ

JULIA ROITTO: Tilaustenhallinta- ja laskutusprosessien uudistaminen globaalissa projektiperusteisessa yrityksessä
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Avainsanat: tilaustenhallinta ja laskutus, projektiperusteinen yritys, tilaustenkirjaus, laskutus, prosessin uudistaminen, projektit, nykytila-analyysi, haasteet, kehityskohteet

Tilaustenhallinta ja laskutus ovat tärkeä osa tilaus-toimitusprosessia, sillä asiakastilauksen on tunnistettu olevan yksi käytetyimmistä tavoista siirtää tietoa eri funktioiden ja organisaatioiden välillä toimitusketjussa. Organisaation on tiedettävä eri tilaustyyppien erikoisvaatimukset hallitakseen ja laskuttaakseen tilauksia tehokkaasti. Tutkimuksen tavoitteena on esitellä globaalin projektiperusteisen yrityksen vaihtelevat tilaustenhallinta- ja laskutusprosessit sekä useita tapoja kehittää niitä. Tietämys erilaisista prosesseista auttaa myös prosessien harmonisoimisessa, jotta saavutetaan standardoituja toimintatapoja, parempilaatuista dataa ja raportteja päätöksentekoon sekä helpotetaan työntekijöiden tehtäviä varastoimalla hiljaista tietoa ja parantamalla toimintatapoja. Prosessiuudistusten avulla voidaan vastata myös nykyisten prosessien haasteisiin ja palvella asiakkaita paremmin.

Tämä diplomityö on tapaustutkimus globaalissa projektiperusteisessa yrityksessä, joka kehittää ja toimittaa automaatiojärjestelmiä, tuotteita ja palveluita sellu-, paperi- ja energiateollisuuteen. Laadullinen data kerättiin haastattelemalla 12 tilaustenkirjaajaa ja havainnoimalla projektien tilaustenhallinta- ja laskutustiimin työntekijöiden toimintaa. Data analysoitiin piirtämällä prosessikuvaajia, vertailemalla tilaustyyppejä yhteenvetotaulukossa ja yleistämällä eroavaisuuksia yleiseen prosessiin. Tutkimus rajattiin koskemaan tilaustyyppejä, jotka esiintyvät projektiperusteisen yrityksen ja sen asiakasyritysten välisessä kaupankäynnissä.

Nykytila-analyysin perusteella projektiperusteisella yrityksellä voi olla hyvin monimuotoisia ja vaihtelevia tilaustenhallinta- ja laskutusprosessia riippuen tilaustyypistä. Esimerkiksi kohdeyrityksessä on 19 toisistaan eroavaa tilaustyyppiä ja 10 erilaista tilaustenhallinta- ja laskutusprosessia. Näitä prosesseja ei voi yhdistää, mutta ne kaikki sisältävät neljä vaihetta (vastaanotto, kirjaus, laskutus ja sulkeminen), joista tilauksen kirjaus on merkittävin. Projektiperusteisen yrityksen tilaustenhallinnan ja laskutuksen merkittävimmät haasteet liittyvät globaalien tilauksien monimutkaisuuteen ja monipuolisuuteen. Tässä diplomityössä esitellään kohdeyritykselle suunniteltu toimintaohje haasteiden hallitsemiseksi myös muiden kuin toiminnanohjausjärjestelmään liittyvien kehitysehdotusten avulla. Organisaatio voi kehittää prosessejaan kategorisoimalla tilaustyyppejä, standardisoimalla prosesseja ja keskittämällä tilaustenhallinta ja laskutustehtäviä sekä kehittämällä funktioiden välistä kommunikointia. Lisäksi yrityksen pitäisi tarjota sekä uusia että päivitettyjä ohjeita, jotka vastaavat myös toteutettuja parannuksia.

PREFACE

This thesis is the biggest independently conducted project I have done and probably will do in my life. I am really proud to say it is ready. Graduating from Tampere University of Technology has been the biggest goal of my life for past five years. I am eagerly looking forward to the new challenges life has to offer me in the future!

First of all, I want to thank Valmet Automation Oy for providing me an interesting assignment and a place to work during the thesis project. Thank you Jari and Eeva for believing me and giving me an opportunity to work also in the ERP implementation project simultaneously. In addition, many thanks to my lovely superior Maarit and team mates Merja, Maija, Sari and summer trainee Viivi. You have always been answering my questions very well and encouraged me through the thesis. In addition, you are a great company during the coffee and lunch breaks.

Secondly, I want to thank you my academic superior, Professor Miia Martinsuo, for your significant participation on this project. You have provided an amazing personal guidance for me with the academic demands, especially with the challenging theoretical background. You have given me unexpected acknowledgement, great advices and fast answers throughout the thesis project.

Thirdly, my family and friends have been an amazing support during this project. My parents Elina and Heikki, you have always believed in me and encouraged me to do my best. Thank you for enabling my education and being so interested in my future. Thank you Aura, my best friend in school and work, for being such a great source of motivation in both studies and free time. I hope we continue challenging each other and having those amazing discussions. All my dear friends in EO Tampere, you have been the best people I have gotten to know during my studies. Thank you for all the Wednesday evenings and many gatherings where I have felt so accepted and loved! I also want to thank Matti, my soul mate, for being by my side through this whole time, for understanding and always loving me! I could not have done this without you!

Tampere, 30.7.2018

Julia Roitto

CONTENTS

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

ATO	Assembly-to-order
AUT	Valmet Automation
AUT unit	Valmet Automation's unit somewhere else than in Finland
BOM	Bill of materials
CODP	Customer order decoupling point
DCS	Distributed control systems (Valmet's product group)
CRM	Customer relationship management system
EDI	Electronic data interchange
eIPO	Electronic internal purchase order
EMEA	Europe, Middle-East, Africa (Valmet's market area)
EPO	External purchase order
EPS	Energy & process systems (Valmet's product group)
ERP	Enterprise resource planning system
ETO	Engineer-to-order
FAT	Factory acceptance test
IPO	Internal purchase order
KLC	Kajaani logistics coordinator
L2L	Lean-to-Lean order (Valmet's internal order inside the ERP system)
MTO	Make-to-order
OMI	Order management and invoicing
PBF	Project-based firm
PBO	Project-based organization
POMI	Project order management and invoicing – team
PO	Purchase order
SCM	Supply chain management
VA	Valmet Automation Oy / VA Finland
VAR	Value added reseller
VAT	Value added tax
VT	Valmet Technologies Oy

1. INTRODUCTION

This master of science thesis is part of a bigger ERP (enterprise resource planning) system implementation project in a global Valmet corporation. This project-based firm wants to get to the bottom of the processes in current organization, to know how the processes and organization could be improved in order to implement the new system as efficiently as possible. This chapter motivates to conduct the extensive current state analysis of the order management and invoicing (OMI) processes. In the research, the scope is limited to order management and invoicing of the order types that occur in global business-to-business sales in a project-based firm. The OMI tasks can be conducted in different functions, but only in Valmet Automation Oy (VA) in Finland.

1.1 Background and purpose

Even though Valmet Automation's plan is to develop the whole end-to-end process with ERP implementation, this research focuses only on the order management and invoicing process. The implementation project has started already in 2016, after Valmet's executive team and the board decided to renew company's ERP tools that currently vary across different business lines and countries. This study focuses only on Valmet Automation (AUT) business line that will start to use the new system in 2019. The purpose of the ERP implementation is to ensure operational excellence by designing and implementing standard project and service delivery processes by using a central ERP application throughout Valmet. By 2020 the project aims to standardize operating procedures, improve data and reporting quality for decision making and ease employees work by storing tacit knowledge and updating ways of working. (Valmet intranet 2018) Therefore, the ERP implementation project provides also a chance to renew many processes in Valmet

Order management, especially order entering, is important, because customer order starts the whole delivery process within an organization (Stock & Douglas in Croxton 2003, p. 26). Company's main goal is to make money by delivering what the customer wants and that is written in the sales order. Therefore, order management gives a lot of critical information to multiple functions inside the company. For instance, purchasing and production activities commonly start after the customer order or they depend on the forecasts done based on the previous sales orders. (Croxton 2003) Actually the order and its associated information flows should be considered as the heart of the business (Christopher 2011, p. 234). In addition, all financial numbers, both the estimates and historical, are-based on the data provided by order management and invoicing. With these numbers company can track its performance, profitability and progress. (Lahti & Salminen 2008)

Order management and invoicing process is not found as a standard term in the literature. In the supply chain management literature, order management means the management of the orders during the whole order fulfillment process, especially in the production (Stadtler & Kilger 2008, p. 101). However, order management can be understood also more specifically only as the order entry process executed by separated order processor before any other tasks of the delivery process. *In this study, the order management is understood as it is organized in Valmet Automation Oy. Therefore, order management is more like a synonym for order entering process, where the order is received, entered and edited by a certain order processor before the delivery process starts*. In other words, order management means simply filling up the customer orders into the ERP system, which requires many tasks from VAT code defining to guarantee application.

In Valmet Automation, all the functions relate somehow to the order management if the term is understood in the broader sense. Customer order includes a lot critical information that the functions use in the ERP system on daily basis. Therefore, it is challenging to define what the order management includes; i.e. draw the start line after the sales and the finish line before the project/service delivery. For instance, quotation management and contract management belong still to the sales and on the other hand, order promising, like delivery date determining belongs already to the next function. (Valmet intranet 2018) The functional scope in order process flow in ERP system in Valmet Automation is shown in the Figure 1.

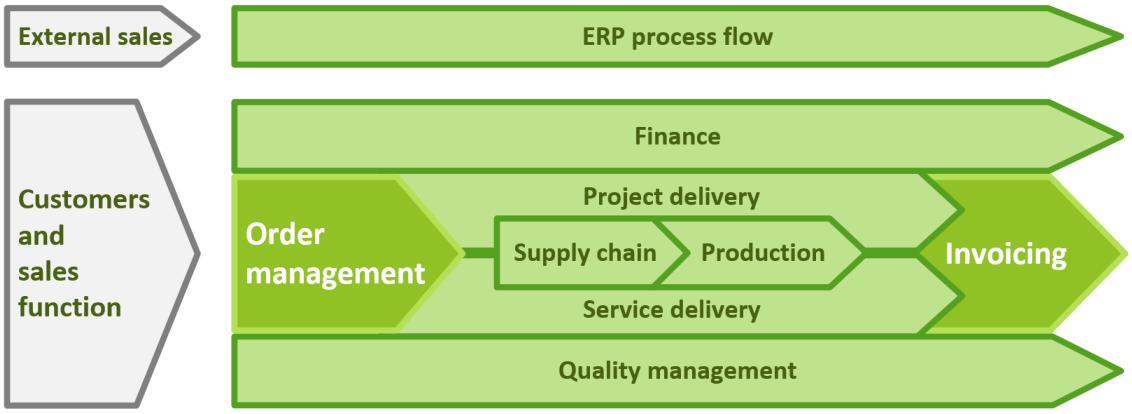

Figure 1. *The functional scope in order process flow in ERP system in Valmet Automation Oy (Valmet internal intranet 2018)*

In the figure, order management and invoicing function is illustrated as two separated parts. This is because with some smaller orders the tasks are separated: order management in the beginning of the process and invoicing in the end, after the delivery. However, in a project-based firm, the invoicing of the projects is usually conducted during the project or service delivery process. Therefore, order management and invoicing is discussed as a one function and uniform order management and invoicing processes in this study.

Valmet Automation's order management and invoicing team (OMI) has been just recently (beginning of 2018) separated as an own function. In addition, a new position of senior manager has been created to take care of all order management and invoicing globally. However, most of the team is still focusing only on main project orders. Therefore, order management is not yet very well-organized process nor a function in AUT. Orders are entered and monitored differently depending on the business and order types, operating countries and even order processors. In addition, the ERP process flow is discontinuous and the orders might be modified several times by different functions. This causes complex processes and extra work for several employees.

After the ERP implementation, order entering and handling must be managed accurately, as the new ERP operates differently and more automatically than the current one. In the new ERP, once entered orders are difficult to alter afterwards. In other words, after a sales order is registered, all necessary information is automatically passed on to the other functions. Therefore, it is important to find out how the orders could be entered correctly to improve processes, enable accurate invoicing and improve customer experience.

1.2 Objectives and research questions

This study discusses about the renewal of current order management and invoicing processes in Valmet Automation Oy in Finland. There are two main objectives in this master thesis. Firstly, *to create* p*erceptive and deep understanding about the current order management and invoicing processes* with process flow demonstrations and extensive summary. Secondly*, to improve the order management and invoicing processes* in order to create a foundation to a globally harmonized and uniform processes. The defined research questions are chosen to support those objectives very closely.

Research questions:

1. What kind of different order management and invoicing processes there are in a global project-based firm?
2. How can a project-based firm improve its order management and invoicing processes?

The questions will be answered by both the theory and practice. Theory is based on supply chain management literature and articles from scientific journals, for instance, International Journal of Project Management. Practice refers to information collected by working in Valmet Automation Oy and interviewing experienced Valmeteers.

These research questions include also some subobjectives within the ERP implementation project. First of all, the goal is to simplify order management and invoicing as a process and as a function in Valmet Automation Oy by harmonizing and merging different order management and invoicing processes and practices. In other words, the objective is to

create global processes that include one set of instructions in standardized ERP interface. Another purpose is to implement those improved processes in other AUT units later. Therefore, it is important to define the main concepts involved in the research questions and how they relate to supply chain management. In other words, one subobjective is to understand how order management and invoicing process relates to supply chain management processes, especially to the order fulfillment process. In addition, this research aims to find out challenges in the processes as well as improvements to them based on the literature and the current state analysis.

1.3 Scope

This study covers order management and invoicing of all order and business types that are recognized in business-to-business sales and in Valmet Automation. According to Lahti & Salminen (2008, p. 78), there are various order types in organization's different sales processes from retail and online sales to project and service sales that all include an own order management and invoicing process. A project-based firm is mostly focused on the project order type, because most of its customers are served with projects (Hobday 2000). Valmet Automation Oy is also mainly manufacturing complex and high capital assemble-to-order (ATO) and engineer-to-order (ETO) products with the project orders. In addition, the case company provides services and smaller products to its customers. *Therefore, this research includes different business-to-business order types from project contract orders to service and sales orders.* However, retail and cash sales and other forms of typical business-to-consumer sales are excluded this study.

This thesis focuses mainly on the order entry, in other words, on the interface between sales and order management. The new OMI function still operates with only the main projects. Therefore, the order management and invoicing tasks of some smaller order types are included into different functions, for instance, sales, service and supply chain. Therefore, *the scope of this study includes also the order management and invoicing executed in other functions than only OMI team.* However, this research does not cover all the tasks conducted by the order processors in the functions, because usually they perform also a lot of other tasks.

Even though Valmet Automation is a global organization, *this study focuses only on the order management and invoicing executed in VA Finland*. Therefore, order management and invoicing in other AUT units is excluded from this research and the units are discussed in the processes only as the customer for VA or as actual sales unit in pass-through cases. In addition, the current ERP system refers to the one used in Finland, even though the Valmet Automation uses three various ERP systems globally. The same system that is used in Finland, is also implemented in Poland, India, China and Northern America and partly in some other countries for special tasks, such as worktime management.

1.4 Structure of the thesis

This study follows the typical structure of a master thesis in industrial engineering and management. After this introduction, the theoretical background discusses about different order management and invoicing processes in a global project-based firm. The process is discussed as a part of order fulfillment process that is one of the main supply chain management processes. Customer order is recognized to be one of the main ways to transfer data between the functions and organization within a supply chain. Literature discusses about order management and invoicing processes in general, even though project-based firm has business-to-business order types from project orders to service and sales orders. In the end of the theoretical background, information systems as well as coordination with sales and customers are highlighted as main ways to improve order management and invoicing in a project-based firm in order to serve customers better. According to the literature, order management and invoicing can improve the customer service level by allowing customer to make changes to the orders during the delivery process and by still ensuring standard delivery time.

This research is conducted as a single case study with a pragmatism research philosophy and inductive approach, like introduced in the methodology chapter. The qualitative data is collected by interviewing 12 order processors and by observing the work of project order management and invoicing team while working as a thesis writer in Valmet Automation Oy in Finland. The data analysis is performed by drawing process graphs, comparing order types in a summary table and generalizing differences into general process. The whole research is mostly a typical master thesis project, even though some of the data collection and analysis is conducted before the relating literature is read. This single case study, that has naturally some limitations, however, the quality is improved, with multiple data sources and detailed description of the research process.

Based on the current state analysis, Valmet Automation Oy has 19 different order types and 10 order management and invoicing processes. The processes are described in detail in ten process graphs and in general with general process that includes following phases: receiving, entering, invoicing and closing. Based on the discussion the main phase of order management and invoicing process is order entry. The analysis is completed with a summary table that enables comparison between the different order types. During the analysis, some challenges (process, general and order type specific) and ideas for improvements came up from the data. The main challenges that project-based firm should focus, are exceptions in processes, inadequate instructions, global supply chain, various order types and global processes. In the end, the research concludes that the best way to handle the challenges are process changes, improved ERP system and coordination between the functions. In addition, the organization should provide new or updated instructions that include training in order to implement them.

2. THEORETICAL BACKGROUND

Order management and invoicing is not found as a process, term nor function in the literature. Still customer order is defined as a document that contains a lot of critical information for all the functions and organizations within a supply chain. This literature review defines order management and invoicing process to be a part of order fulfillment process that is one of the main supply chain management processes. The theory explains that even though global project-based firms manufacture mostly projects they also have, for instance, engineer-to-order manufactured product sales. Information systems and coordination with sales and customers are introduced as main ways to improve order management and invoicing in a project-based firm in order to serve customers better.

2.1 Main concepts

No firm can stand alone in the global markets and be good at performing all the tasks. Therefore, every global organization needs other organizations to cover the whole process from order to delivery and to compete in the global markets. This system is called the supply chain. (Skjøtt-Larsen et al. 2007, p. 17) It is important to understand the concept of the supply chain management, because customer order and order management are closely linked to it. Actually, order management and invoicing process is a short but important part of order fulfillment process, that is one of the supply chain management processes.

2.1.1 Supply chain management

Supply chain *is "a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer".* In addition to the flow and transformation of the goods, supply chain covers all associated information and monetary flows. (Christopher 2011, p. 13) Typically, supply chain includes five main parties (customer, distribution, final manufacturing, first and second tier suppliers) before the raw materials (Skjøtt-Larsen et al. 2007, p. 33-34). This study focuses on the role of a manufacturer company, where the manufacturer has direct interface with its customers in order to have own order management and invoicing. All the organizations inside the supply chain should cooperate closely to accomplish common objectives and to serve the customers as well as possible (Skjøtt-Larsen et al. 2007, p. 17). However, sometimes it might be challenging to subsume the narrow interest of one party for the benefit of the whole chain. In addition to the main participants, the network includes supporting enterprises to provide transport, communications and other specialized functions. (Skjøtt-Larsen et al. 2007, p. 17) Figure 2 presents a general approach of a global supply chain.

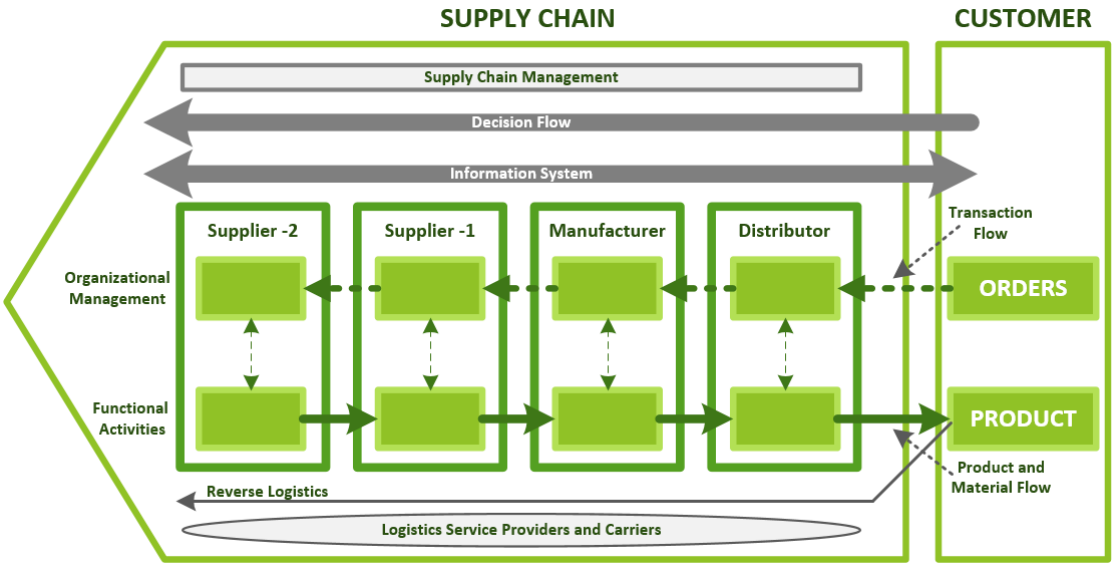

Figure 2. *General global supply chain (adapted Skjøtt-Larsen et al. 2007, p. 34)*

In the Figure 2, *supply chain is linear series of operations that are organized around the flow of materials, that begins with an order from a customer and ends with customer receiving the products or service* (Stadtler & Kilger 2008). In this general model, the products and materials flow right, towards the customer. However, transactions and orders flow left, which determines the supply chain direction. The products that are returned or repaired move upstream from customers to previous stages. Information flows in both directions, because it should be available to all participants in the supply chain. (Skjøtt-Larsen et al. 2007, p. 33-34)

The supply chain may also be longer or shorter depending on the approach. According to Mentzer (2001, cited in Skjøtt-Larsen et al. 2007), supply chain can be characterized into basic, extended and ultimate supply chain based on the extend of it. Basic supply chain consists of the focal company and its immediate supplier and customer, when ultimate supply chain involves all companies from the initial supplier to the ultimate customer. According to Stadtler and Kilger (2008, p. 9), the term supply chain is also used for a large company with several sites often located in different countries. Therefore, it is important to notice that in Valmet Automation's internal communication term 'supply chain' refers to the internal network of supply centers and it includes procurement and all logistics (Valmet internal AUT procedures 2018).

In another model, supply chain is a dynamic system, that consist of activities, organizations and processes. ***Activities*** *are value adding tasks and the foundation of the supply chain system managed with the individual processes.* Therefore, the single activities, the building blocks of the processes, can be reorganized, augmented, eliminated or shifted between organizations if needed for improving the performance of the supply chain. ***Organization*** *is a party, for instance a distributor, inside the supply chain that performs the activities in its internal and external units*. Organizations can be also created, expanded,

contracted or eliminated within the supply chain. (Skjøtt-Larsen et al. 2007, p. 27-28) The processes, on the other hand, can be categorized and determined in various ways depending on the extend of the process. In addition to the normal processes, also business processes and operating processes are found in the supply chain management literature.

Process *is a customer value-adding chain of activities that utilizes resources which company manages to accomplish its own objectives* (Martinsuo & Blomqvist 2010, p. 1). In other words, process transforms an input (need) to an output (result) to meet the demand of customers and need of stakeholders (Palmberg 2009, p. 204). Process can be simple or complex, predetermined or undetermined, however, it pursues to achieve an objective set by an external or internal customer (Martinsuo & Blomqvist 2010, p. 4). Skjøtt-Larsen et al. (2007, p. 43) have found out different definitions for a business process in the literature. In most of the definitions ***business process*** *covers the entire supply chain from the original supplier to the end customer and includes value adding for customer and other stakeholders through products, services and information*. Business processes link the activities as set of coordinated activities to the organizations. For instance, order fulfillment, customer service, procure-to-pay and time-to-market are business processes.

In the literature, ***supply chain management (SCM)*** *is defined simply as "the integration and management of key business processes across the supply chain*" (Croxton 2003, p. 20). SCM encompasses the planning and management of all activities involved in sourcing, procurement and logistics management. It also includes collaboration with the different organizations. (Skjøtt-Larsen et al. 2007, p. 20) There are several ways to determine how the different concepts relate to each other in supply chain management context. For instance, the concepts can be discussed as hierarchical process categories that are: process, subprocess, activity and task (Palmberg 2009, p. 208). This hierarchical determination is also exploited in this study, but it is extended with the concepts of business process and operating process. An example of the conceptual map of the key concepts of this study is illustrated in the Figure 3.

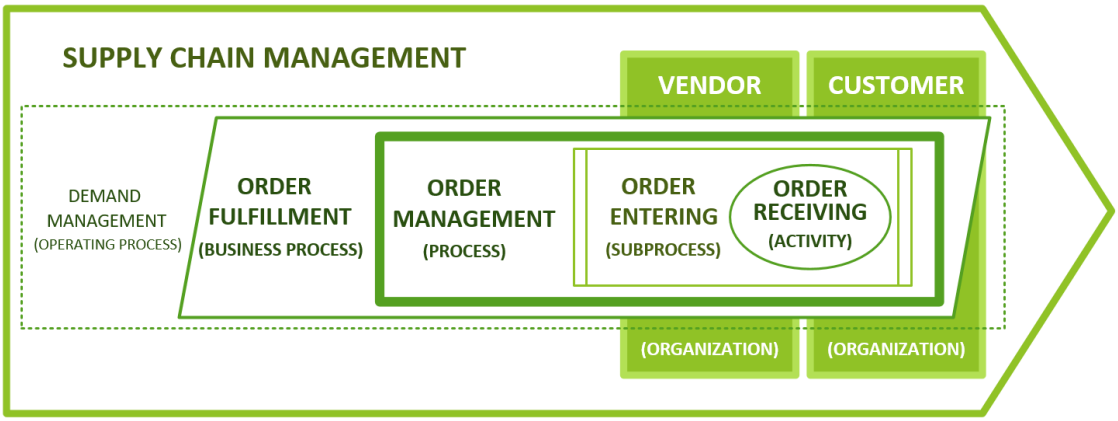

Figure 3. *An example of relations between different concepts in supply chain management*

In the Figure 3, the different concepts are placed hierarchically inside each other. Supply chain management is the main concept that covers all the processes, organizations and activities. Order receiving is an activity that is performed together by a customer and a vendor, for instance distributor. It crosses organizational boundaries and requires coordination and earlier settled procedures. Therefore, it is a component activity in an order fulfillment process which in turn is part of overall supply chain management process. (Skjøtt-Larsen et al. 2007, p. 27-28) A process can be large and cross-functional like order fulfillment or relatively narrow like order entering. Therefore, order management can be considered as a cross-functional process or a subprocess of order fulfillment. Similarly, order entry can be a subprocess of order management as in Figure 3 or a process itself.

According to Skjøtt-Larsen et al. (2007, p. 28), operating processes that include the business processes, are used to manage supply chain system. The five **operating processes** are, demand management, distribution, production, procurement and product development. However, the operating process is not widely discussed by other authors and therefore it is marked only with the dash line in the Figure 3. For instance, Croxton (2003) has included those operating processes into the key business processes that are used for supply chain management. He stated that business processes include operational and strategic subprocesses that also include few activities. This Croxton's structure is used in this study and therefore more closely introduced in Subchapter 2.2.

2.1.2 Project-based firm

The offering of large and complex products and systems has caused firms to adopt project as a specific form of organizing their business activities like production and innovation (Hobday 2000). In different industries, the unique solutions might include complex systems with multiple technologies and integrated components from multiple subcontractors (Artto et al. 2015). ***Project*** *is a temporary organization that uses different specific resources to achieve beneficial change* designed by quantitative and qualitative objectives (Turner et al. 2014). Hobday (2000, p. 874) completes the definition by stating that within a project-based firm the ***project*** *is the primary business mechanism for coordinating and integrating all the main business functions of the firm.* Project integrates e.g. production, research & development, engineering, new product development, marketing, personnel and finance. In addition, it is used for creating and responding to new business opportunities.

Project-based firm (PBF) *is a company that does most of its work (internal and external activities) in projects and/or have a main attention on the project dimensions rather than the functional dimensions of organizational structure and processes* (Lindkvist 2004; Sydow et al. 2004; Hobday 2000). According to Artto et al. (2015, p. 71), PBFs customize and deliver complex capital goods (products and systems) to their customers. Usually these projects include a certain well-defined product and one (or few) identified customers that normally are closely involved in primary innovation and production processes,

because normally projects are critical for the customers' operations and performance (Hobday 2000, p. 875). According to Miterev et al. (2017), there are several names for the project-based firm, for instance, project-based organization, multi-project firm, project-intensive firm, projectified matrix organization and project-oriented company. They have differentiated *project-based firms* as temporary legal entities created around a specific project outcome and **project-based organizations (PBOs)** as permanent structures incorporating multiple projects. This study focuses on the later. However, these terms are used as synonyms, like firm, company and organization.

PBOs can either be entire companies (as in consultancy and construction) or multi-firm consortiums or networks (Hobday 2000, p. 874). In this study, PBO refers to a single firm instead of a group of companies. The term PBO relates to both private manufacturing enterprise and other organizations (public and private). Project-based organization's size can vary from large prime contractors to tiny specialized subcontractors as well as PBO can be managing simultaneously only one single project or hundreds of projects. (Hobday 2000, p. 874) There are also different organizational forms of project-based organizations, however, all of them involve the creation of temporary systems to perform the project tasks (Sydow et al. 2004, p. 1475). In addition, projects can be executed within the boundaries of single company or they may involve a consortium of firms. However, not all the companies related to a project are necessarily PBFs. (Hobday 2000, p. 874–875)

In addition to the project-based organization, Hobday (2000, p. 877) introduces also the other types of organizations where functional and matrix organizations are the opposites to the PBO. In the functional organization, business functions are carried out in functional lines and in matrix organizations they are executed in both projects and functional lines. However, within a pure PBF core business processes and most, if not all, business functions are organized within projects. Therefore, project-led organization, where the needs of projects outweigh the functional influence on decision-making and depiction to senior management, but some coordination across project lines occurs is quite similar to the project-based firm. In this study, project-led organizations will be considered as included in the PBO concept, because the pure PBO is quite specialized type of organization.

According to Turner et al. (2014), the whole society is now recognized considerably project-oriented, because project-based management is the new general management and 30 % of the global economy is project-based. Project-based firms are common in various industries, for instance in traditional industries (e.g., shipbuilding and construction), with new technology regenerated industries (e.g., aerospace and telecommunications) and newly rising industries (e.g., information and communication technologies) (Hobday 2000, p. 875). In addition, PBOs are found in consulting and professional services, high-technology, cultural industries and complex products and systems in business-to-business markets. (Sydow et al. 2004, p. 1475) In many of these industries, PBOs are better than functional and matrix organizations to manage the challenges with increasing product

complexity, fast changing markets, cross-functional business expertise, customer-focused innovation and technological uncertainty (Hobday 2000, p. 871).

Despite the industry, many firms are initiating more and more projects, while their main operations and productive activities might be volume-based or operations-oriented (Sydow et al. 2004, p. 1475). However, these projects are normally internal improvement projects, because PBF is not really suited to the mass production of consumer goods. For instance, large manufacturing companies might use projects to organize specific non-routine activities and complex tasks like research & development and advertising campaigns. In addition, in order to deal with different types of technologies, products and markets, some large multiproduct firms combine both PBO and functional divisions. (Hobday 2000, p. 875)

2.1.3 Customer order types

Customer order *is a commercial document given to the vendor about the products/service that customer has committed to buy and pay.* The document includes all necessary data for order delivery process, for instance, customer details as well as payment and delivery terms. (Lahti & Salminen 2008) Customer order can be a formal or informal document or negotiated and signed contract or agreement. Therefore, orders might come from the sales force or directly, usually electronically, from the customer. (Skjøtt-Larsen et al. 2007, p. 106) In any case, customer order type determines the required order management and invoicing process (Lahti & Salminen 2008, p. 78).

Project order is obviously the main customer order type in a project-based organization. Project order is usually a negotiated and signed contract that covers the details for invoicing installments during the relatively long delivery time. Some projects, typically smaller projects, can be sold also with order and offer combination. (Lahti & Salminen 2008, p. 78) According to Artto et al. (2015, p. 71), project-based firms are normally engaged to their customers during the whole system life cycle by providing also services after the project delivery phase in order to integrate more closely to customer's operations. Therefore, service order is also an important customer order type in this research context. Service orders can be divided into pre-made service agreements and service orders that are issued after the need is recognized. The agreements are typically negotiated and entered to the system for longer period of time and the invoicing occurs periodically, hopefully also automatically, as agreed. (Lahti & Salminen 2008, p. 82) In addition to the project and service orders, project-based firms might also have smaller orders that require assembly-to-order (ATO) or engineer-to-order (ETO) manufacturing. These "order-based orders" require a delivery and they are typically invoiced after the delivery. These orders might include both products and labor (including services). (Lahti & Salminen 2008, p. 81) The small orders can be thought as small projects, but without project management activities.

All the operations in a supply chain and the companies start with the customer order (Croxton 2003, p. 19). However, the operations might be done based on the upcoming customer orders or the customer order might serve as input data to different forecasts like future demand and production schedule, depending on the nature of the production systems (Skjøtt-Larsen et al. 2007, p. 106). For instance, in engineer-to-order manufacturing, engineering of the customer-specific products starts after the order is received. However, in make-to-stock production business customer is served directly from the stock and the order increases the need to refill the stock (Stadtler & Kilger 2008). In all cases, supply chain operates to fulfill customers' orders (Croxton 2003).

2.1.4 Order management and invoicing

Customer orders include a lot of critical information, therefore filling them efficiently and correctly is crucial (Croxton 2003, p. 19). According to Fawcett & Fawcett (2014, p. 43), a "perfect" order is received, processed, picked, packed, shipped, documented and delivered on time without damage. In other words, an error in customer order, for instance with delivery time, creates an imperfect order. Every organization should aim to keep its customers happy and to fulfill orders perfectly. In order to do that, organization has to manage their order entering. Order management is one function in the supply chain like inventory management, production or transport management (Skjøtt-Larsen et al. 2007, p. 115).

In this study, order entering and order management are basically synonyms. Therefore, ***order management*** *means filling up the customer orders into the information management systems*. It is also called as order placement or order acquisition. In the literature, order management is defined as controlling and managing customer order throughout the order life cycle. This definition includes the order entering and order promise but also tasks during other functions like production and delivery. (Stadtler & Kilger 2008, p. 101) In conventional organizations, order fulfillment process is separated into different functions: order entry by sales or commercial function and then credit control, production planning, manufacturing or assembling, distribution, transportation and invoicing by other functions. In this kind of sequential process, every function performs its task and then moves the order to the next function. Therefore, the order fulfillment is not covered or managed by one function, because at each step the order is "thrown over the wall". In other words, every function manages the order independently and no one else knows about order's status. (Christopher 2011, p. 232)

In supply chain process, all operations are activated by series of transactions that trigger the movement of products and materials (Skjøtt-Larsen et al. 2007, p. 105). Therefore, actions that create the transactions, for instance invoicing, are vital for the supply chain. According to Bowersox et al (2002, cited in Skjøtt-Larsen et al. 2007, p. 103), both order management and invoicing, as well as, pricing and customer inquiry are transactional logistics information. Transactional information is formalized, standardized and routine

information that records individual logistics activities and functions. Transactional information is the basic information inside the system. Therefore, it is important to manage and control it effectively and correctly.

Invoicing *means creating and sending invoice(s) to the customer based on the agreed commercial terms.* Invoice, on the other hand, is an itemized bill for products or services sold, containing individual prices, the total charge and the terms. (Lahti & Salminen 2008) When customer pays the invoice, a transaction called payment appears. For clarification, customer's payment transactions can be both simple and complex, depending on the commercial terms and is the invoice required. For instance, in retail business payment transactions are quite simple, because the payments are executed at the counter at the moment of purchase and therefore invoicing is not required. However, in business-to-business environment invoicing is typical, also for smaller orders. (Lahti & Salminen 2008)

Invoicing might occur before, during or after the delivery. In addition, one order might include several installments divided into, for instance, advance and final invoices. The commercial terms about how to invoice the customer, are normally defined already by the sales force. Payment terms define when the customer is expected to pay the invoice and therefore, how long it takes before the vendor sees the payment transaction after sending the invoice. Invoicing process does not normally include the payment tracking, because it is separated to the financial function and invoicing is executed by the order processors/order management function. (Lahti & Salminen 2008)

2.2 Order management and invoicing in supply chain management processes

As stated before, supply chain is a dynamic system that consist of different organizations, processes and activities. Following subchapters concentrate on the processes that are used to demonstrate the supply chain management and the entire structure of the supply chain. This research utilizes Croxton's (2003) model to explain why order management and invoicing process is included in order fulfillment process. According to the literature, order management and invoicing can improve the customer service level by allowing customer to make changes for orders during the delivery process and by ensuring standard delivery time.

2.2.1 Supply chain management processes

The Global Supply Chain Forum (a group of leading global firms conducting research in supply chain management) has identified eight main supply chain management processes. These processes are vital for the supply chain and therefore, they need to be implemented in all the firms across the whole supply chain. (Croxton 2003, p. 19) Each process is a system of their own, of which nature and quantity might vary depending on the supply

chain. Therefore, supply chain must choose which processes are to be in focus and with what level of integration. (Skjøtt-Larsen et al. 2007) In addition, the importance or the content of the processes may vary between different organizations within the supply chain (Stadtler & Kilger 2008, p. 39). The SCM processes as well as different functions and organizations inside the supply chain are shown in the Figure 4.

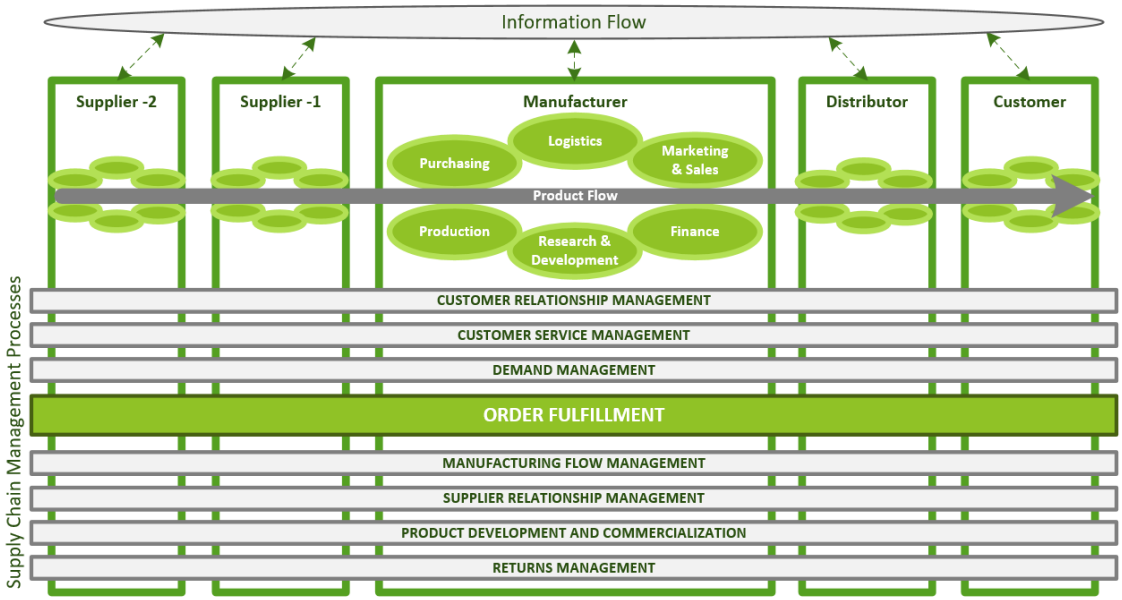

Figure 4. *Supply chain management processes (adapted Croxton 2003, p. 20)*

Each of the processes includes subprocesses and activities (Croxton 2003, p. 19). This study focuses only on order fulfillment process that includes all the activities used to define customer requirements, design the logistics network and fulfill customer orders. Especially defining the customer requirements, that includes order entry, is in the scope. The other processes are customer relationship management, customer service management, demand management, manufacturing flow management, supplier relationship management, product development and commercialization and returns management. The first two relate closely to each other and customers, the next two to production/manufacturing and the last ones to products' features. Supplier relationship management is like customer relationship management, but the product/service agreements are with suppliers instead of customers. (Croxton 2003, p. 20)

2.2.2 Order fulfillment process

Order fulfillment *is a key process in supply chain management that includes generating, filling, delivering and servicing customer orders.* Sometimes the process determines the customer experience, because the customer might interact with the organization only through this process. Order fulfillment process is end-to-end process that requires all the functions from logistics, marketing, research and development, finance, purchasing and

production. In addition, it includes coordination with key suppliers and customers. (Croxton 2003, p. 19) According to Christopher (2011, p. 235), order fulfillment is simply the process of converting an order into cash. The process focuses on transactions at the operational level, while at the strategic level management can focus on making improvements to the process that influence the financial performance of the firm, its customers and its suppliers. (Croxton 2003, p. 19)

Order fulfillment process has both operational and strategic elements. Similarly, the process is divided into two parts. Operational process, that is on focus in this study, covers the execution of the process once an order is established by managing the customer order cycle. Strategic process is for the management to create and manage the structure of the operational order fulfillment process. These strategic subprocesses include, for instance, reviewing of marketing strategy, defining requirements for order fulfillment and evaluating of logistics network. (Croxton 2003, p. 21) The operational order fulfillment process and how it is related to the main supply chain processes and which activities the subprocesses include are presented in the Figure 5.

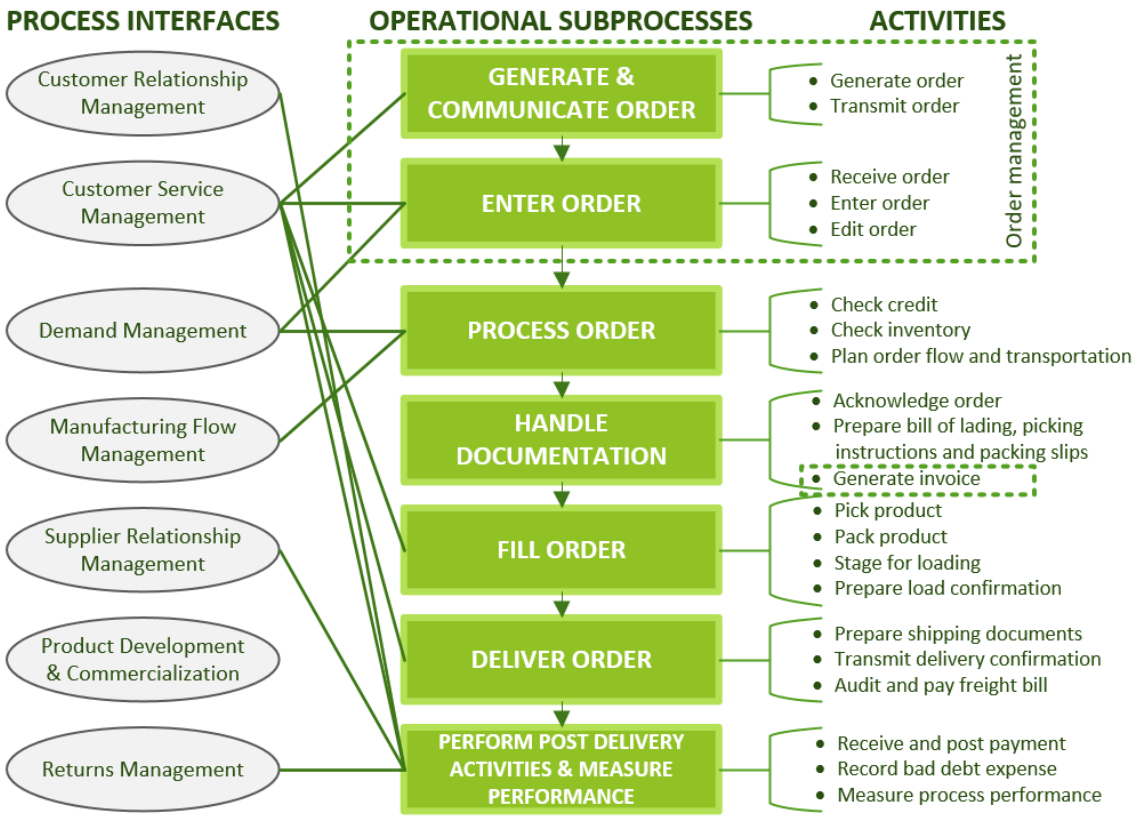

Figure 5. *Operational order fulfillment process (adapted Croxton 2003, p. 27)*

The operational order fulfillment process has seven subprocesses which all have a few activities. The subprocesses are 1) generate and communicate order, 2) enter order, 3) process order, 4) handle documentation, 5) fill order, 6) deliver order and 7) perform post-

delivery activities and measure performance. The first six are steps in the order-to-delivery process, while the last one occurs after the delivery and includes activities mainly for customer payments and improving overall process performance. (Croxton 2003, p. 27)

The whole order fulfillment process should be led by a cross-functional and cross-departmental team that comprises of managers from several functions. This team is responsible for both developing the procedures at the strategic level and ensuring that they are also taken into action. (Croxton 2003, p. 21) The idea of the team is to cluster together the steps and activities in the process and bring also the people involved together. Thus, the order fulfillment group might consist of people from sales office, credit control and account, production and transport. When all the key people linked to the management of the order are brought together they are better able to sort out problems and eliminate bottlenecks. Therefore, order cycle times can be dramatically reduced as teamwork prevails over interdepartmental rivalry. (Christopher 2011, p. 235)

Both the strategic and operational subprocesses have interfaces with the other seven supply chain management processes. These interfaces mean data transfer and information and idea sharing between the process teams. In the operational order fulfillment process, customer order is the main communication message between the subprocesses and the main processes. Customer order also activates the order fulfillment process. Therefore, it is natural to integrate also key customers to the supply chain to simplify the order-to-cash cycle and make it as cost-effective as possible. (Croxton 2003, p. 27) Way to integrate customers to the process are information systems that are discussed in the Subchapter 2.3.

2.2.3 Order management in order fulfillment process

By the broader definition, order management means managing and controlling customer orders throughout the entire order life cycle, i.e. from the first customer inquiry to the delivery of an order (Stadtler & Kilger 2008, p. 294). This definition covers the whole operational order fulfillment process. In general level, this process can be divided into two phases: order acquisition and order fulfillment (Forza & Salvador 2002, cited in Tenhiälä & Ketokivi, 2012). This study focuses on order acquisition, in other words, the first two subprocesses that are included inside the case company's definition of order management. According to the literature review of Tenhiälä & Ketokivi (2012), order acquisition covers the beginning of the order fulfillment process in the customer interface, where the main challenges are 1) to configure producible and technically feasible solutions that correspond to the heterogeneous customer needs and 2) to determine the delivery dates that are possible in terms of available resources.

The first subprocess of the order fulfillment process is **generating and communicating the order**. According to Stadtler and Kilger (2008, p. 9), organization handles simultaneously many different customer orders. In many cases, orders come through the internal sales organization or customer service. (Croxton 2003, p. 28) The order might also be an

external order directly from the end customer or indirectly from the intermediary institutions (Gudehus 2005, cited in Skjøtt-Larsen et al. 2007). In some companies, this order transmit from customer is automated with technologies. According to Skjøtt-Larsen et al. (2007, p. 62), order placement, order confirmation and invoicing are increasingly handled electronically, which has significantly reduced both administrative tasks and transaction costs of the order-to-cash business process. In other companies, the sales process might be very labor intensive, because of the negotiations and other work done to generate the right customer order (Croxton 2003, p. 28). Therefore, order management operates with sales processes that cover most of the order acquisition. In addition, sales function is closest to the customer, so it must deal with consumption patterns and preferences and transmit external customer orders. (Skjøtt-Larsen et al. 2007, p. 136)

After the order is received, it needs to be entered and possibly edited. Therefore, **order entering** is the second subprocess in order fulfillment process. (Croxton 2003, p. 28) Typically, customer order contains several order lines for different product families (Stadtler & Kilger 2008, p. 77). However, sometimes the orders that are received, do not include all the required information, because of an issue with the sales process or with the customers. If the orders are not completed because of, for instance, sales people's incomplete offers, the process team should work with the sales to correct the offers to give customers complete information for their orders. (Croxton 2003, p. 28)

Before creating an order acknowledgement, and sending it to customer, organization has to also make a credit check for the customer (Croxton 2003, p. 29). With projects, a guarantee or letter of credit are typically used to ensure that the organization receives the payments from the customer (Lahti & Salminen 2008, p. 164). However, the credit check is not included in the order management definition in this study. In addition, many researches (e.g. Stadtler & Kilger 2008; Christopher 2011; Croxton 2003) has include also the order promising subprocess (delivery date determination) in the order management process. However, this study does not cover it, because it is executed by production or some other function than order management and invoicing in the case company. In addition, order management might include order tracking and exception management (Christopher 2011, p. 142). According to Croxton (2003), these two are usually covered by the customer service.

The customer order data is also required for some other SCM processes. Customer service management needs it to inform customers about the order status and demand management for generating future forecasts. Therefore, after order entering the information is shared to these supply chain management processes, as shown in the Figure 6. (Croxton 2003, p. 28) It is beneficial to all the SCM processes and the whole supply chain if the shared information is correct and as quickly shared as possible. After generating, communicating and entering the order the actual fulfillment phase starts. These subprocesses include mainly production and supply chain related activities such as inventory checking, picking, packing and shipping. (Croxton 2003, p. 28) According to Stadtler and Kilger (2008, p.

186), if there are configuration options in the order for customer to choose from, the configuration is usually determined at order entry time. Then bill of materials for (configured) product is made based on the customer order entry.

2.2.4 Invoicing in order fulfillment process

In the operational order fulfillment process (Figure 5), the invoicing is only slightly discussed. Process model just states that invoice is generated after the order is processed and planned in the documentation handling subprocess (Croxton 2003). However, invoicing is critical function for the organization. If the invoicing process is poorly managed and the invoices are delayed or incorrect, the firm's other operations might be compromised because of the poor liquidity situation. In addition, invoicing has an interface with the customer. Therefore, it can be thought as a customer service itself. (Lahti & Salminen 2008, p. 73)

Invoicing process has four main phases: invoice creation, invoice sending, filing and registration of accounts receivable. Therefore, the process ends when customer's payment transaction is allocated to accounts receivable and entries are shown in the main accounting. (Lahti & Salminen 2008, p. 73) This study focuses only on the first two phases in the beginning of the invoicing process. According to Lahti and Salminen (2008, p. 77), sales **invoice is created** by selecting the products or services customer has ordered from the product catalog or by saving the product details manually to the invoice. Use of the product catalog expedites invoice generating, ensures the right pricing and eases many financial activities. Other information like customer details and delivery terms for the invoice are copied from other documents like customer order and customer register. Value added tax (VAT) code can be inserted manually or be determined by the system that includes all necessary information.

Invoice generating electronically and as automatically as possible has usually greater impact on organizations efficiency than sending the invoice electronically. However, many organization still do a lot of manual work inside the electronic invoicing system. For example, when someone is creating an invoice he might look the needed information from another system and then retype it to the actual invoicing system. Therefore, organization must confirm that data is automatically transferred from its original source to the invoice to avoid unnecessary data handling in various functions. (Lahti & Salminen 2008, p. 78) After all necessary data is correctly in the system, invoice generating could be only confirming the automatically created invoice.

Depending on the organization, it might have several, few or only one information system in an active use. In any case, organization has to secure the complete interface between them in order to manage information and execute processes efficiently. Invoicing might happen in the general ERP system or in a separated invoicing system. Either way, customers' billing details has to be stored in customer register. This can be covered in a

separated system, for instance in customer relationship management (CRM) system, or in the ERP. In addition, invoicing might require information from, for instance, sales and project management tools. (Lahti & Salminen 2008, p. 79)

There are different types of sales invoicing processes depending on how the payment is executed. Sales that *require a delivery*, usually start with the customer order that is registered to ERP system or separated sales tool as a customer sales order. Sales order includes all necessary information and therefore it can be automatically converted into a sales invoice after the goods are delivered. Usually this invoicing does not require manual work at all. *Agreement based invoicing* covers periodically repeating often fixed price invoices, for instance rents or service agreements. After the agreement is once registered to the invoicing system, it generates the invoices automatically. However, this might require manual work for starting the batch run. Sold *projects* are usually delivered during a long period of time based on a negotiated contract. Therefore, they need to be invoiced with several payment installments. Installment invoices are created usually after the project manager marks certain milestone achieved and thus an installment ready for invoicing. (Lahti & Salminen 2008, p. 81–82)

In addition, there are also other sales invoicing processes. Process invoices are created based on customer's use of certain service, for instance engineering hours. Recharging invoices, on the other hand, are invoices used to recharge travel expenses from the customer. Both the process and recharging invoices can be handled as independent invoices or to be connected to an order. (Lahti & Salminen 2008, p. 80–83) In all the processes, the goal is to utilize self-service and information from its original source. In this case, self-service means that billing details could be entered to the system (or support systems) already by the employees in the sales or service functions or the customers themselves. (Lahti & Salminen 2008, p. 78) In addition to the introduced invoicing processes, all the organization might have situations where none of the previous matches the requirements. Therefore, there must be a possibility to enter the billing details manually to create a special invoice. (Lahti & Salminen 2008, p. 84)

Organization **sends the invoice** to the customer somehow electronically or then manually as a printed paper document with regular mail. Electronic ways to send an invoice are as EDI invoices, e-invoices and e-mail invoices. However, e-mail invoice, that is a pdf-file attached to an e-mail, is not a real electronic invoice, because it requires manual work and the data cannot be directly transmitted to customer's information systems. EDI (electronic data interchange) invoice is the oldest electronic invoice that is created according to the EDI structure standards for organizations to interchange data electronically and efficiently. They are often used by large organizations that have high invoice volumes or then sent via a telecommunications service provider. An e-invoice, on the other hand, is constructed according to a generally used message format, whose data can be handled and interpreted automatically. However, they are transmitted to the customers via a telecommunications service provider or a bank, because the data has to be converted into different

systems or another service provider or sometimes printed out as a paper document. In any case, organization must have the billing details registered in their own customer relationship management system. (Lahti & Salminen 2008, p. 84–88)

2.2.5 Order management and invoicing in a project-based firm

As mentioned before, project-based firm provides unique but somehow also similar products and systems to its customers. Therefore, PBFs work mainly with engineer-to-order (ETO) manufacturing, where every product is the ultimate result of a project and the unique orders may be managed like a project. (Yang 2013, p. 109) In general, ETO organization has low volumes but high variety of complex products that are developed based on the customer demand in order to satisfy their needs perfectly. The order requires always at least some degree of engineering work to adapt an existing design or create a completely new one. (Mello et al 2015, p. 1005)

Also assemble-to-order (ATO) manufacturing is included in the scope of this research, because some of the products in the project-based frim can be only configurated according to the customer order. ETO and ATO are different supply chain structures that describe the range of possible operations. One of the main characteristic to categorize supply chain structure is ***customer order decoupling point (CODP)****, where the part of the supply chain that is driven by the customer orders is separated from the part that uses forecast planning.* (Gosling & Naim 2009, p. 743) In other words, decoupling point is the first stage in the flow of material, where a further processing step will only be completed against a customer order (Stadtler & Kilger 2008, p. 70).

In ***engineer-to-order*** *environment, the CODP is located at the design stage, so every order is designed individually based on the customer requirements.* (Gosling & Naim 2009, p. 741) The customer designed elements are essential part of the order fulfillment process. Therefore, customers are generally involved to define the final product with the engineers and the products cannot be stored in the inventory. (Yang 2013, p. 109) According to the literature review of Gosling and Naim (2009, p. 744), the definition of the ETO supply chain has different variations. However, most of the authors agree that they operate in project specific environments. *In* ***assemble-to-order*** *environment, the CODP is established in the assembly stage, so the products are designed before the order, but are customized and assembled based on an order* (Koho 2010, p. iii). In other words, ATO production is typically modular and the standardized parts are stored in the warehouse. Therefore, product configuration that tailors the product customer-specifically based on various standardized options, is a main factor in order processing in ATO production. (Stadtler & Kilger 2008, p. 79) In addition, ATO companies usually have predefined objectives, plans, policies and rules that structure their customer order processing (Derks & Weston 2005, p. 210).

Derks & Weston (2005, p. 210) have determined that ETO companies have many similarities with make-to-order (MTO) companies in the sales order processing. In make-to-order context, procurement is driven by forecast, however production, final assembly and distribution are driven by the customer order, like in ETO environment (Stadtler & Kilger 2008, p. 187). In other words, the decoupling point is one step closer to a customer, therefore the engineering is not yet customer specific. In both of the supply chain types, sales order processing is primarily centered on processing so-called bid related data. Bid is an offer provided for the customer before it is approved with a customer order. Important issues in bid preparation relate to quoting lead-times, assessment of relevant manufacturing capabilities and selection of profitable orders. Therefore, sales activities and functions must be coordinated with design, engineering and make activities and functions. On the contrary to ETO and MTO environments, ATO companies are high procedural, i.e. the activities that need to be performed to process a sales order are typically prespecified. Therefore, well-structured business activities are needed in ATO to achieve, for instance, demand level forecasting, quote and proposal generation, order configuration methods and price and discount policies. (Derks & Weston 2005, p. 210)

In make-to-order production approach, the CODP is between the ETO and ATO production. Therefore, MTO is like ETO with order-specific part production and like ATO with standard designing of the products. In all the approaches, assembly is done order-specifically. (Koho 2010, p. 5) Especially ETO and MTO manufacturing approaches work with a pull strategy, where supply chain operates based on the received orders that are treated individually as quickly as possible (Skjøtt-Larsen et al. 2007, p. 140). Therefore, some specifications introduced related to the MTO environment can be generalized also to project-based firm that operates mostly in ETO and ATO environment.

Tenhiälä & Ketokivi (2012) have analyzed in their research how the product customization affects order management in processes that produce complex MTO-products, like heavy-duty industrial cranes, high-technology weapons systems and special-purpose elevators. Even though customization is a common strategy in MTO manufacturing, not all manufacturers customize their products. Therefore, manufacturers are either non-customizers, custom assemblers or custom producers. According to their study, each of the gestalts requires different order management practices, product configurator software, available-to-promise verifications and configuration management, depending on the level of customization.

In the MTO context, customer order records the essential information that specifies what must be produced (product specifications) and when the products must be finished (promised delivery dates). Order management covers *product conformance* by ensuring product specifications match customers' needs and *delivery performance* by enhancing ability to obtain possible production schedules and precise and reliable delivery date promises. (Tenhiälä & Ketokivi 2012, p. 175) Product conformance and delivery performance are also considered the most appropriate measures for the effectiveness of order management

(Tenhiälä & Ketokivi 2012, p. 183). The same applies also in the project environment, where customer order is an important document that is actually an agreement that binds both sides. Therefore, the promises made in the sales function are also valid in the order management process and other processes and functions.

Tenhiälä & Ketokivi (2012, p. 177) concluded in their literature review, that the product specifications and delivery dates, specified by the sales personnel, are seldom fixed in the MTO context. Typically, customer makes changes to the order. Therefore, the main challenge of order management in the order fulfillment phase is to respond to the amendments customers request. Unfortunately, these changes often have adverse performance effects to the other orders. According to Danese & Romano (2004, cited in Tenhiälä & Ketokivi 2012), MTO manufacturers often feel pressure to approve the changes because freezing the product specifications and delivery schedules already in the order acquisition phase is generally considered unacceptable customer service. Diligent management of order documents can alleviate these difficulties. If manufacturing problems are communicated by updating the documents, sales personnel will get advance information about the upcoming delivery problems and consequently, will have extra time to negotiate alternative arrangements with the customers. (Tenhiälä & Ketokivi 2012, p. 177)

Most, if not all, of project-based firms' sales require a delivery. Smaller orders, that are not projects, are normally invoiced based on the customer order that is updated after the goods are delivered. Generally, delivery marks customer order as 'ready for invoicing' that enables automatically generated sales invoice with the next batch run of the system. Projects, on the other hand, are invoiced with several payment installments that are agreed with the contract. Usually the project manager is on charge of determining that a certain milestone is achieved and an installment is ready for invoicing. Because of the extended length of the delivery, projects might include some arrangements, to ensure that the firm receives the payment from the customer. These could be a guarantee or letter of credit from the buyer's bank. (Lahti & Salminen 2008, p. 164)

2.2.6 Order management and invoicing as service for customers

Customer service management is a supply chain management process of its own. However, order management and invoicing process has an important two-way interface with the customer service function. Customer service function requires data from order management to perform and serve the customers. In addition, customer service function might receive customer orders that are then transmitted to order management function for processing. (Croxton 2003) According to Innis and La Londe (1994, p. 3), ***customer service*** *is a process, that provides significant value-adding benefits to the supply chain in a cost-effective way.* It is divided into two subunits: those related to physical distribution service and those related to other functional units in the organization. Therefore, customer service is *all the assistance and advice organization provides* to those who buy and use its products and services.

According to Christopher (2011, p. 31), there are three groups of customer service actions: pre-transaction, transaction and post-transaction activities. The activities before the customer order entry depend on the scope of the order. According to Vickery et al (2003, p. 536), pre-sales customer service is the activities organization does to serve the customer before the purchase. Standard products ordered routinely do not necessarily need any customer service. However, large projects, like a building project, requires several intense personal links between the parties at different levels of the hierarchy. (Stadtler & Kilger 2008, p. 13) Therefore, order management, sales, customer service and other related functions are organized in various ways in different organizations depending on their offerings. In the order management and invoicing context, the last two stages of customer service activities are in the focus.

Serving customers is important also in the order management and invoicing process. Firstly, a flexible and easy ordering process is one of the customer service activities. (Skjøtt-Larsen et al. 2007, p. 62) Filling up customer orders, that put the whole supply chain in motion, efficiently and effectively is the first step in providing good service for customers (Croxton 2003, p. 19). Customer service may be also information about current status and location of an order during the delivery (Stadtler & Kilger 2008, p. 13). Providing the information about time and place of an order for customers, improves product's 'value-in-use' that will be recognized after the products are in the hands of the customers (Christopher 2011, p. 22). In addition, flexibility to meet individual customer requirements might be the most important element for winning an order (Stadtler & Kilger 2008, p. 13). Therefore, customer service is the result of the entire organization or supply chain: it yields from the combined efforts of all functions (Vickery et al. 2003, p. 526).

Customer service level might be measured by three main key performance indicators: the on-time delivery, the order fill rate and order lead-time (Stadtler & Kilger 2008, p. 294). Order management and invoicing process has a quite significant impact to all of them. If the orders are entered negligently and the customer order data in the ERP system is incorrect, it has a major effect to other functions and the whole order fulfillment process. In addition, it decreases organization's customer service level. Therefore, order cycle time plays an important role in a project-based firm, where the goods are made on the demand (Stadtler & Kilger 2008, p. 13). ***Order cycle time*** *is the total time between order placement and customer receiving the right goods* (Christopher 2011, p. 51). Order cycle time is also known as delivery/waiting time, that customer must wait until the delivery after ordering (Skjøtt-Larsen et al. 2007, p. 141). From customer's point of view, order cycle time is the only lead time and therefore a major source of competitive advantage to the organization. (Christopher 2011, p. 125)

Order cycle is also referred as order-to-delivery cycle (Christopher 2011, p. 235) and order-to-cash cycle (Croxton 2003 and Skjøtt-Larsen et al. 2007, p. 62) in the literature. Therefore, there are also minor disagreements about the components and steps of the cycle. Most the authors have agreed that the reliability or consistency of order cycle time is

equally important than the duration, because of the just-in-time working methods. If the variability of the cycle time is high, customers need more safety stocks (Christopher 2011, p. 125). Therefore, organization does not necessarily need to reduce the order cycle time, but to secure its average duration (Croxton 2003, p. 30). Actually, according to Stock and Douglas (2001, cited in Croxton 2003, p. 30), the decline in the variability has more financial impact than a decline in the average cycle time. Hult (1997, cited in Gardiner et al. 2002) has also noticed that reduction of the cycle time has a positive impact not only for customer satisfaction but also quality and performance of the process.

According to Christopher (2011, p. 125), every step of the cycle has a unique time range of duration, because of bottlenecks, inefficient processes and fluctuations in the volume of orders handled. In addition, the cumulative nature of the process may cause considerable variations to the entire order cycle time. Customers want to know the when to expect the order to arrive (the mean) and what is the worst-case scenario (the upper end of the range) (Fawett & Fawett 2014, p. 198). Concluding, order-cycle time and the performance of order management and invoicing process affects both on-time delivery and order lead time that define the customer service level. Customer service performance is important, because Innis and La Londe (1994, p. 19) found out that it affects also customer's attitude.

On the contrary, customer service level can be also used as a measure about the performance of the order management and invoicing process. When the competition in the market increases, order management and therefore also customer service gets more important. (Stadtler & Kilger 2008, p. 294) According to Christopher (2011, p. 22), customers do not demand only better product quality, but also better service.

2.3 Improving order management and invoicing process

Change to more profitable organization and better performance requires three types of changes: process, system and organizational improvements. This study discusses mainly the process change, however, also the system and organization related improvements are introduced in this chapter. According to the literature, information systems and coordination with sales and customer are efficient ways to improve order management and invoicing processes.

2.3.1 Information systems in order management and invoicing

The development of the technology in the supply chain environment has had a major effect on order fulfillment process. Today many manual tasks, for instance, placing an order for a standard item, can be maintained by computer. The entire process, from transmitting the order until the consignment's receiving and checking, could also be controlled by the computer. (Stadtler & Kilger 2008, p. 17) Manual steps in the process have been automated by the implementation of technology such as electronic data interchange (EDI), the internet, available-to-promise (ATP) system and enterprise resource planning

(ERP) system. These technologies provide managers information that can be used throughout the whole supply chain to lighten the organization and order fulfillment process. (Croxton 2003, p. 27)

The introduction of these technologies has had two remarkable effects on the order fulfillment process. Firstly, the order-to-cash cycle has shortened days by streamlining the operational process. For instance, in one company, an electronic ordering system has reduced order processing costs by 60 % and time by 30 %. In addition, the 60 % decreased average order fulfillment time has also reduced customer's ordering costs by 12 %. Secondly, the technology improves companies' ability to integrate to other organizations within the supply chain and thereby reduces the steps in the process. For instance, the first two operational subprocesses in order fulfillment process (generate & communicate order and enter order) could be covered in one step. The technologies can cover order accepting and move order for processing, where the order flow and even transportation planning might be automatically executed. (Croxton 2003, p. 27)

This integration between organizations in the supply chain, usually takes place between the focal-firm and its customers, which also reduces order entry errors that might be costly and time consuming to correct. In addition, with the technologies company can give trace-and-track capabilities to customers, which lowers the workload in customer service team and thereby improves customer service. The implementation of these technologies can be win-win for multiple members in the supply chain. However, the technology has substantial costs and thereby order fulfillment team must analyze the costs against the value added by each technology. (Croxton 2003, p. 27–28) Technology should not be integrated or updated just to do it, it should improve company's performance. Most of these technologies are useful for the whole order fulfillment process, however, this study focuses on ERP system that is most used technology in order management and invoicing process.

Enterprise resource planning (ERP) system

Enterprise resource planning systems has become a vital cornerstone technology for nearly every type of transaction in a manufacturing organization (Stadtler & Kilger 2008, p. viii). ***"Enterprise resource planning (ERP) systems*** *are software packages that manage and integrate all the enterprise's data and provide information based on this data on a real-time basis"* (Gefen & Ragowsky 2005, p. 18). According to Stadtler & Kilger (2008, p. viii), ERP provides a continuous compounded database for corporate wide data, for instance, customer orders, purchase orders and invoices. In addition, ERP systems integrate many processes, even those that span multiple functional areas in an organization. Therefore, ERP systems help to integrate and harmonize internal processes, especially order entry and production planning, in the entire organization (Su & Yang 2010, p. 81).

In addition, ERP systems can help the organization to achieve competitive advantage through improved business performance by, for example, integrating supply chain management, customer order management, production planning, shipping, accounting and all other modules that operate in the cross-organizational business processes. (Kalling 2003) Also Stadtler and Kilger (2008, p. 75) emphasize that several units in the same organization have to exchange information horizontally, therefore it should flow freely in the ERP system. Derks and Weston (2005, p. 210) extended the scope on the ERP, by stating that the responsibilities and commitments of order management and invoicing process normally span multiple (and often distributed) organizational boundaries.

Skjøtt-Larsen et al. (2007, p. 118) are suspicious that no single software can cover the whole supply chain, hence multiple software programs are typically used for the end-to-end processing of customer orders. For instance, a project-based firm cannot use ERP for the project manufacturing or project management, because it does not provide visibility on project manufacturing as a whole or include all the necessary information for project management. Therefore, project managers must use parallel systems. (Korpivaara et al. 2014) Fortunately, it is quite easy to integrate other systems to an enterprise resource planning system. Su & Yang (2010, p. 81) have argued that with implemented ERP systems, it is possible to share large amounts of information along the supply chain. Many firms are actually considering deploying ERP system mainly to integrate their suppliers and/or customers to the same system.

Estimated costs for ERP software package are several million dollars for large companies with more than $80M annual sales (Gefen and Ragowsky 2005, p. 18). In addition to the large costs, implementing an ERP system may also be risky because of its inflexibility that makes it often difficult to implement across all units and functions within an organization (Su & Yang 2010, p. 82). Skjøtt-Larsen et al. (2007, p. 113) have also stated that ERP is hard to implement because of the mere size of the task, initial data requirements and compatibility with other systems. Several researches have reported that some businesses have invested a lot of money in ERP or other technologies without positive results. In addition, some academic research is suspicious of ERP system's benefits and its results in terms of a firm's performance. (Su & Yang 2010, p. 82) Therefore, this study introduces three papers that have concluded ERP systems to have at least some significant benefits for the organization and also to the order management and invoicing process.

2.3.2 Benefits of an enterprise resource planning system

Gefen and Ragowsky (2005) have studied the benefits of an ERP system in 270 manufacturing organization that implemented an initial ERP system in the end of 90's. They categorize the benefits ERP systems can produce in two levels: an enterprise level and a specific IT module level. Most of the business operating characteristics that are measured in the study, relate to manufacturing. These are, for instance, differences among the sup-

pliers, average lead-time of the raw materials, product complexity and number of production lines. These numeric characteristics are used to describe, for instance, how much information is needed, thus how useful ERP system is.

Their study shows a major difference between the two levels: on the specific module level, the benefit from an ERP was high (around 40 %) and low (around 6–11 %) on an organizational level. They concluded that this may explain why so many ERP implementation projects seem to fail. Because the system is kind of a one-size-fits-all application, organizations might forget that the ERP should be installed to address specific needs and to fit in with organization's business characteristics. Therefore, the benefits acquired from an ERP system vary between the different modules and organizations depending on the business. (Gefen and Ragowsky 2005) Also Gardiner et al. (2002, p. 360) give a warning example about organization that was too focused on developing and optimizing its business processes and had then difficulties to find software to support those. Therefore, if the ERP system is implemented to fulfill certain requirements, it is usually helpful and profitable for the organization.

Gardiner, Hanna and LaTour (2002) provide in their research an illustrative insight and case examples of how an ERP system as a tool can improve performance level of a supply chain while reducing cycle times and enhancing customer service. According to their article, ERP technology can reduce cycle times significantly and the whole supply chain performance with wider data sharing, quicker order fulfillment, better demand and inventory management, more precise deliveries and improved customer service level. For example, after implementing an ERP system Applied Micro Circuits could respond customer inquiries immediately online and Fujitsu Microelectronics on the other hand reduced quotation time 90 % and improved on-time delivery to customers up to 85 %.

As an illustrative example, the article highlights the streamlined sales order process that is similar to customer order management and invoicing process. Therefore, ERP systems provide benefits for order management and invoicing. Some might say, that ERP (or other technology) is a necessity for the process to function. The article stated that customer order is a central document in ERP system. With an ERP system, orders are entered based on the preceding inquiries and quotations. In addition, the system includes master data, the prerecorded information about rarely changing subjects like addresses for customers, products and suppliers. When order processor is creating an order, master data are pulled automatically into the document, so the order processor has to fill up only some order specific data. The system generates also a unique number for the order to identify it. (Gardiner et al. 2002) All this saves time and reduces errors in the order entry phase.

Tenhiälä and Ketokivi (2012, p. 176) agree that order acquisition (that includes order entry) is vulnerable for errors and waste of resources without appropriate investments in information processing tools, that ensure effective information flow between sales, engi-

neering and manufacturing functions. ERP system helps to transfer customer order information as documents to other functions, also for invoicing function after the delivery. (Gardiner et al. 2002) In addition, ERP system provides a clear workflow for order processing with predefined activities that can be executed only in certain order. Typically, the customer order has only a limited number of specific states in the system, for instance, 'order created', 'ready for invoicing' and 'invoiced'. (Derks & Weston 2005, p. 221)

Su & Yang (2010, p. 81) introduced in their article different ERP benefits and studied their impacts on three supply chain management competencies: operational process, planning and control process and behavioral process. According to article, with a fully realized ERP systems, organization achieves reduced cycle times, faster transactions, better financial management and possibility to use e-commerce or e-business operations. In addition, with an ERP the entire organization is linked seamlessly together, providing immediate information and making tacit knowledge explicit. As a matter of fact, the benefits of an integrated ERP system are so significant that many organization are happy to execute the demanding implementation project. In their research, ERP benefits are categorized into five groups that all include several ERP benefits that Su and Yang determined based on their literature review. These benefits are listed in the Table 1.

Table 1. *ERP benefits (adapted Su & Yang 2010, p. 84)*

Operational benefits	Managerial benefits	Strategic benefits	IT infrastructure benefits	Organizational benefits
Cost reduction	Resource management	Worldwide expansion	Flexibility	Changing work patterns
Cycle time reduction	Decision making and planning	Business alliance	IT cost reduction	Organizational learning
Productivity improvement	Performance improvement	Business innovations	Enabling e-commerce	Empowerment
Quality improvement	Partnership with customer + supplier	Cost leadership	Information management	Common vision
Customer service improvement	Scheduling	Product differentiation	Improved IT architecture	Employee morale
Error reduction	External linkages	External linkages	Single interface	Behavior

Operational benefits of ERP system are the outcome of automated cross-functional processes and data use that enable organization to plan and manage production, manpower, inventory and physical resources and control the financial performance of products, customers, business lines and geographic areas. *Managerial benefits*, on the other hand, improve the day-to-day business process, resulting long-term benefits like enhanced customer satisfaction and responsiveness with on-time delivery. *Strategic benefits* issue from the ERP system's capability to support organization strategy by, for instance, supporting

business growth and reducing cost of maintaining legacy systems. *IT infrastructure benefits* that are obvious for the ERP, include business flexibility building, reduced IT costs with standardized procedures and single interface for users. *Organizational benefits* support organizational changes by supporting workers' learning, training and empowering and building a common vision, better employee morale and satisfaction. (Su & Yang 2010, p. 84)

According to the data, that in the research is collected from Taiwanese IT firms, operational, managerial and strategic ERP benefits have positive impact on the SCM competencies. However, IT infrastructure and organizational have negative effects. In addition, they concluded that more than 80% of respondents felt that it is necessary to first adopt an ERP system as the cornerstone of company operations before implementing other enterprise systems, like the SCM system. They found out that literature has also agreed that ERP system is quite mandatory for large firms to operate in current competition. Therefore, the question for organization is not whether to deploy an ERP system, but how to best implement it so that organization's and supply chain's performance are improved. (Su & Yang 2010)

2.3.3 Coordination with the sales and customers

In addition to the enterprise resource planning system and other technologies, also better working methods can improve order management and invoicing process. Therefore, order management and invoicing process can be improved with cooperating with other functions, especially with sales and customers. For example, order entering might be outsourced for customers to help streamline the process and to reduce the errors. However, some companies have noticed that although customers make the process easier they make more mistakes, probably because they are not as well trained as organization's internal people. (Croxton 2003, p. 28)

Many organizations have difficulties to integrate different functions, because they are used to do their own tasks (Christopher 2011, p. 232). Several authors have argued that the poor coordination among different functions that execute the projects with specific requirements and product changes is one of the main reasons for delays that in turn increases the order cycle time and reduces the customer service level (Mello et al. 2015, p. 1006). For instance, one company (Herman Miller) redesigned their sales process so that customers designed their orders (office spaces) as they wanted them in a software that also created order lists and final prices for the order. The same software was also used to generate the orders which streamlined also the order entry process and deducted the errors. (Croxton 2003, p. 28)

Tenhiälä and Ketokivi (2012, p. 176) concluded in their literature review that customers of a project-based firms, demand not only fast and accurate delivery but also increasingly

sophisticated and tailored products. Therefore, the feasibility for both the technical specifications and delivery dates must be ensured already in the sales function. They argued, that PC tools, often embedded in ERP systems, offer one solution to the information processing challenges in the order acquisition phase. These tools, such as configurators, formalize the rules about how products can be configured. In addition, PC tools provide user interfaces that help customers to articulate their needs and sales personnel to translate desired features into technical specifications. If the data is flawless and comprehensive already in the sales function, the errors in the order entry phase are also reduced.

The precise information from the sales is the key to success. If the organization wants to deliver goods that customer has ordered, the customer order must be entered correctly. Therefore, the functions must coordinate their work. For instance, sales function must delivery all the necessary information for order processors. Mello, Strandhagen and Alfnes (2015) analyze coordination in ETO supply chains that execute complex projects. They study contingent factors that cause project delays in shipbuilding business. The article focuses on coordination between engineering and production functions that are the main phases of ETO supply chain that require coordination. They concluded that the integration of the functions and production capability are the most critical factors in the coordination between manufacturing and engineering in an ETO supply chain. However, some of the aspects in the article can be generalized also to sales/marketing that is the third main phase.

Generally, ***coordination*** *is a managerial task that is responsible for lining up the decisions of different functions to reach a common goal*. (Mello et al 2015, p. 1007) Malone and Crowston (1994) have defined coordination as "the act of managing dependencies between entities and the joint effort of entities working together towards mutually defined goals". Coordination has become more significant for the organization when they have started to focus on providing a short and reliable order cycle time. However, the high degree of project customization in the ETO supply chains has an increasing impact on the delivery time. Organizations in ETO supply chains have challenges to cope with the various customer requirements and simultaneously to deliver the highest quality in a highly uncertain environment. (Mello et al 2015, p. 1005)

Mello et al. (2015, p. 1007–1008) summarized in their articles theoretical background, that coordination of supply chain's processes in ETO business requires specific coordination mechanisms which can be used with high tailored orders. High project complexity originates from the complex product structures and the occasional demand for different items. For instance, job rotation and mobility, sharing preliminary information and cross-functional teams are mechanisms to improve coordination. In addition, the best fitting coordination mechanism may also change during the project delivery. In the production and engineering context, the orders are rarely similar or repetitive, however, in the order management and invoicing process the orders are processed quite similarly even though they include different contents. Some authors state that the more the project progresses

the higher is the need for formal coordination mechanisms. Artto et al (2015, p. 71), added, that separated project and service organizations within the company has possibly a negative impact on the management of customer relationships from the perspective of the entire firm's long-term business.

2.4 Synthesis of the literature

Order management and invoicing is not found as process, term nor function in the literature. In this thesis, order management and invoicing is discussed as an important process in the supply chain and organizations. The process consists of subprocesses that include many value adding tasks called activities. In addition, order management and invoicing process can be seen as a part of the business process called order fulfillment, even though it is not discussed with this name or scope in the literature. Order fulfillment process, on the other hand, is recognized and discussed in the literature. The terminology within supply chain and the categorization to subprocesses, processes and business processes is not that simple, because literature gives different options. Therefore, the different concepts used in this thesis are introduced in the Figure 6.

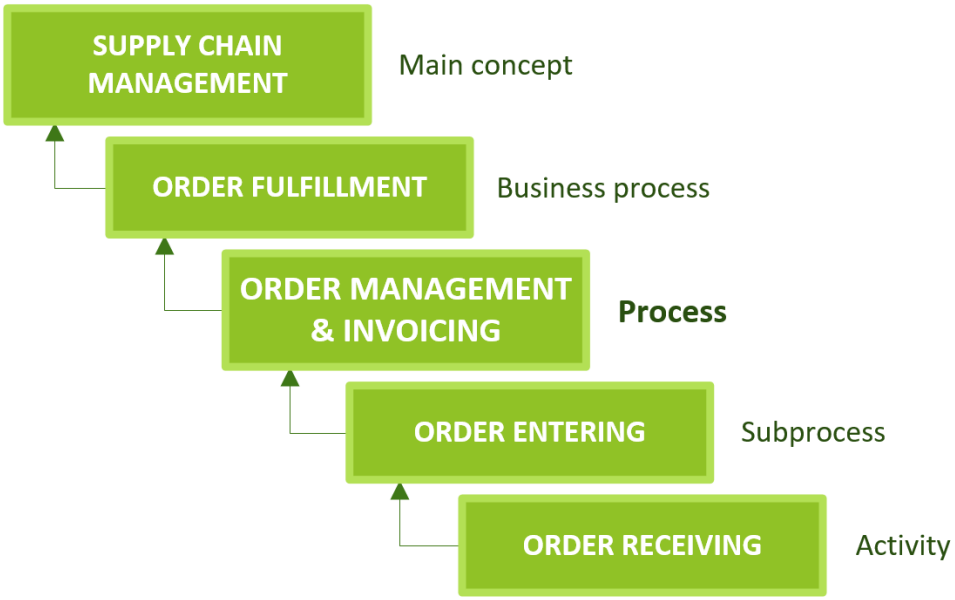

Figure 6. *Conceptual map of the research*

The empirical research has recognized *customer order* to be an important document within the whole supply chain and organization. In the Figure 6 and this thesis in general, term *order* refers to the customer order that is a binding commercial document between organization and end customer about the products or service. In today's business environments customer orders are managed in various information systems, for instance, in enterprise resource planning system. In a project-based firm, that does most of its work with projects (or project orders), also other order types (service and product sales) are recognized to occur. However, in the literature, these order types are not separated into

own order management and invoicing processes. According to the literature, the orders are managed the same way, even though they might be invoiced differently. Therefore, the empirical research could discuss about the special requirements of various order types in order management and invoicing processes.

According to the empirical research, order management and invoicing can improve the customer service level by allowing customer to make changes for orders during the delivery process and by ensuring standard delivery time. That is because, customers require both complex and unique solutions as well as fast deliveries that are measured with order cycle time. However, in some research, it is found out to be quite difficult to have short order cycle and fast delivery in project-based organization, because most of the complex products and systems are engineer-to-order or assemble-to-order manufacturing. The research has concluded, that the further customer order decoupling point is from the customer, the longer order lead time is, since more activities are executed after the order is received.

The writers have agreed that the organization should ensure that it delivers the “perfect order”, for example, right goods at the right time. In order to do that, the customer orders must be entered correctly into the ERP system that can provide the data effectively through the whole organization or to other organizations in the supply chain. Literature has recognized ERP system to be crucial for manufacturing company. In addition, it is one of the main ways to improve order management and invoicing processes in a project-based firm. According to the empirical researches, organizations that use fully realized ERP systems and coordinate the interface between customers, sales and order entry function can gain many operational, managerial, strategic, organizational and IT infrastructure benefits. For example, the cycle times can be reduced and correct information might flow faster. Therefore, organizations are able to improve their performance and the customer service level.

3. RESEARCH METHODOLOGY

Based on the research onion (Saunders et al. 2009) this research is an inductive case study with a pragmatism research philosophy. The qualitative data is collected with interviews and observation while working in the target company Valmet Automation Oy in Finland. The data is analyzed by drawing process graphs, comparing order types in a summary table and generalizing differences into general process. The research process is mostly a typical master thesis project, however, some of the data collection and data analysis is executed before the relating literature is read.

3.1 Research approach

This research is executed by the commission from the target company. The commission includes quite clear and specified research problem and research questions. Therefore, many practical working methods for this research are pre-defined. However, Saunders et al. (2009) have argued that before focusing on the research questions and data collection, researchers should be considering other issues, like research philosophy and approach that determine the 'big picture'. Therefore, they have provided a framework that covers all the critical issues of a scientific research. This framework, with the concepts of this study highlighted, is introduced in the Figure 7.

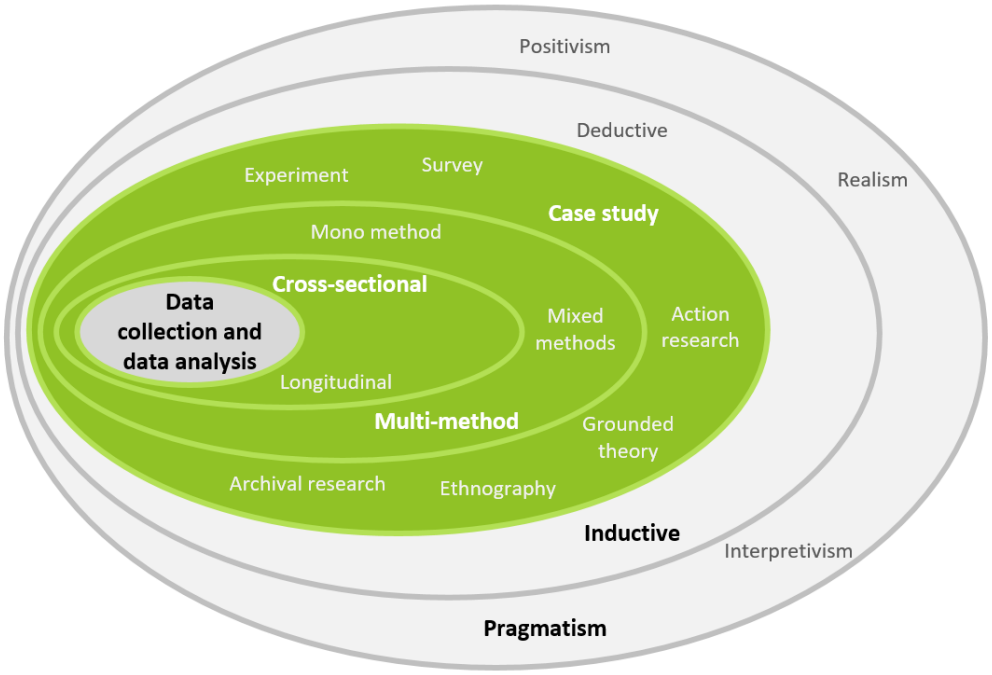

Figure 7. *Research onion in this thesis (adapted Saunders 2009, p. 138)*

This framework is commonly used among business and management researches. The framework is called 'research onion', because it should be peeled away layer by layer in

order to understand the research as a whole. In addition, the choices in the outer layers impact also to the inner layers by, for example, providing limitations. (Saunders 2009, p. 138) The layers and the concepts used in this study are more closely discussed in this chapter. However, the middle layer of the onion is introduced in own Subchapter 3.4.

This research is executed with *pragmatism research philosophy,* that determines the main guidelines of the research. Research philosophy defines how the researcher sees the world, especially the truth, reality and knowledge. Ontology concerns the nature of reality, for instance, is it objective or subjective. Epistemology determines what is knowledge and axiology relates to the role of values in researches. However, in *pragmatism research philosophy the most important determinant is the research question.* It is used to define ontology, epistemology and axiology that cannot usually be predefined in practical research. Pragmatism considers that reality is not a single one but multiple, because single viewpoint can never give the entire picture. Therefore, multiple methods of data collection are commonly used in researches under pragmatism philosophy. (Saunders et al. 2009, p. 108–116)

It is not obvious what research philosophy to use in this thesis, because the research could also have been executed with a interpretivism philosophy where reality, knowledge and truth are subjective and based on the rich and small qualitative data (Saunders et al. 2009, p. 116). On the other hand, it could be conducted as a constructive research that is usually linked to real-life problem, that is resolved with an innovative solution construction based on theory and practical knowledge. Construction is, for example, a model, framework or commercial product, that is formed as a result of planning and development that differs from the existing artefacts (Lukka 2000, cited in Rautiainen et al. 2017). In this thesis, a construction was previously an objective: an improved global model for order management and invoicing process,. However, during the thesis work, the construction was left out of the objectives, because the target company had so little information about the current order management and invoicing processes and the scope would have been too wide. In addition, Valmet Automation has so many different order types that is hard to merge them all.

This thesis is mainly conducted with *an inductive research approach* that starts with the data collection and observations that are used to build a theory. This research approach, i.e. the second layer of the onion, describes the approach for solving the research problem. This research provides a model for order management and invoicing process in a project-based firm based on the analysis of the collected data. In other words, theory is used to help to understand the reasons and explanations for noticed phenomena. The research focuses on rich qualitative data with informal research process, that might include changes in research questions or arrangements. Inductive approach differs greatly from the formal deductive approach, where theory is tested with wide quantitative data in a linear predefined research process. (Saunders et al. 2009, p. 124–127)

This thesis is conducted with *a case study strategy*. According to Robson (2002 cited in Saunders et al. 2009, p. 145), it is empirical research strategy for current complex real-life phenomenon studied with multiple sources of evidence. The context of the study is highly important because the boundaries between the studied phenomenon and context are not precisely evident (Yin 2009). In other words, the case is difficult to separate from its context, because case study strategy helps to gain a rich understanding of the context and the performed processes (Morris & Wood 1991, cited in Saunders et al. 2009, p. 146). According to Yin (2009), there are different types of case study strategies. *This case study involves a single case* rather than multiple case. The case is the target company Valmet Automation that is more closely introduced in the next subchapter. This research is also embedded case study rather than holistic case, because order management and invoicing process is divided into logical subunits based on the business or product type. In addition, the various processes are analyzed as separated units.

This research is *an exploratory study* that seeks what is happening in project-based firms' order management and invoicing processes. According to Saunders et al. (2009, p. 146), case study strategy is commonly used in explanatory and exploratory research. In addition, it is very suitable for answering to the questions 'why' and 'how' in situations that researcher cannot affect (Yin 2009). Therefore, it is a good strategy for answering the main research question: *"How can a project-based firm improve its order management and invoicing processes?"* To do that, researcher must choose how to collect and analyze the data. The way to define these research choices is illustrated in the Figure 8.

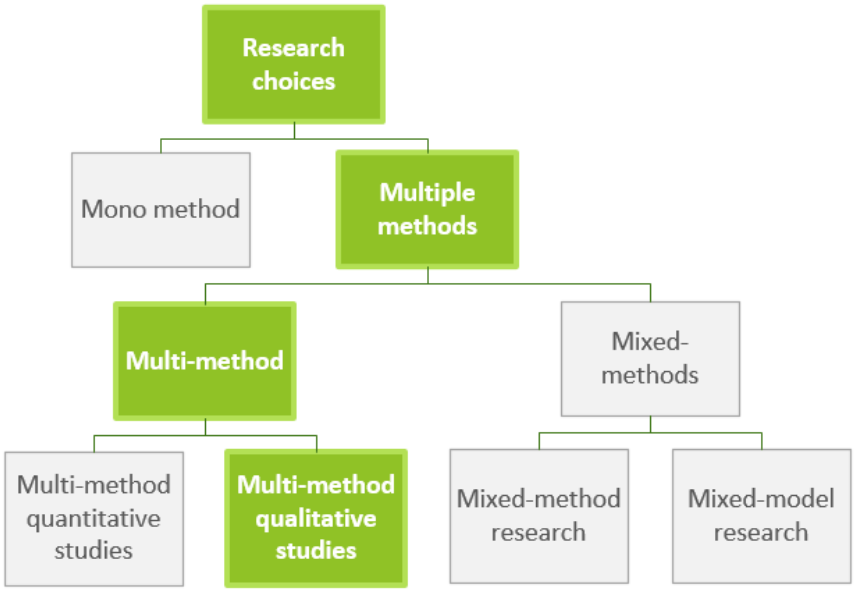

Figure 8. *Research choices in this thesis (adapted Saunders et al. 2009, p. 152)*

This study is *a multi-method qualitative research*, therefore different mixed-methods are not introduced in this thesis. A multi-method is a combination of more than one data collection techniques used with associated analyzing procedures. A multi-method is only either quantitative or qualitative study depending on the data sources. Before selecting

between multi-method and mixed-methods the researcher has to first to determine whether to use either a mono method or multiple methods. Like the terms themselves describe, a mono method includes one and multiple methods several data collection techniques and analysis procedures. Multiple methods are either multi-method or mixed-methods. (Saunders et al. 2009, p. 152)

This research includes only *qualitative data* that is usually complex and non-standardized data. Hence, qualitative data needs to be restructured, categorized and summarized in order to analyze it. In addition, qualitative data analysis usually involves the creation of a conceptual framework. (Saunders et al. 2009, p. 482) In this thesis, most of the qualitative data is collected with semi-structured interviews and observation. The data is analyzed by categorizing and summarizing it into a table that enable the comparison. The data collection and analysis are more closely discussed in the Chapter 3.4. Quantitative data, on the other hand, would be simple and standard data, for instance numbers in ERP system, that contains only a little meaning before it is processed and analyzed with graphs and charts. (Saunders et al. 2009, p. 414)

This thesis is *a cross-sectional research*, that is studying a certain phenomenon at a particular time. This study is like a snapshot of the situation, because only certain phenomenon, in this case current state of order management and invoicing process, is analyzed in the target company. In the fifth layer of the onion, the time-horizon of the study, could also be defined as a longitudinal. Longitudinal study has a longer data collecting process that enables studying of development or change unlike the cross-sectional research. These last three inner layers (research strategy, choice and time horizon that are marked with green in Figure 7) formulate the research design. (Saunders et al 2009, p. 155)

3.2 Target company

Valmet corporation (Valmet Oyj) is a world-leading industrial company that offers process technologies, automation and services for its customers. Valmet serves its customer companies mainly in pulp, paper and energy industries. In 2017, the company had EUR 3,159 million of total net sales and almost 12 300 employees. Valmet has its origin in 1797 established Tampereen verkatehdas, that first produced different fabrics like felt and satin. Later it produced cloths and felts to paper machines. In 1950s Valmet had a broad product portfolio from planes and ships to paper machines and tractors. However, in 1999 when Metso was created through the merger of Valmet and Rauma, the company focused only on paper and pulp industries. After that, the company has expanded its product and service offering to the current extent and has become Valmet again. Valmet shares have been traded in Nasdaq Helsinki since the beginning of 2014, after Metso Group demerged into two separate companies in the end of the previous year. All in all, the company has over 220 years of industrial history in Finland. (Valmet 2018A)

Valmet's vision is to become the global champion in serving its customers. The corporation is located globally in 33 countries next to its customers. Valmet has over 120 service centres, 86 sales offices, 34 production units and 16 research & development centres, mostly located in EMEA (Europe, Middle East and Africa). Company's headquarters is in Espoo in Finland. The other main locations are also in Finland. Therefore, EMEA is company's main business area with 46 % share of the orders received and over 8 000 employees in 2017. North America (21 %) and China (17 %) are also significant areas for the corporation. In addition to the areas, the corporation can be divided into four business lines that are from the greatest to the smallest: service, pulp & energy, paper and automation. Pulp & energy and paper businesses are considered as 'capital business', where the business is quite cyclical and volatile, because it is driven by the new investments in the mills and machinery. Service and automation, on the other hand, are referred as 'stable business', because the markets are more stable and only slightly growing and driven by the size of the already installed base and mill operating rates. (Valmet 2018A)

Valmet Automation that is the actual target company of this thesis, is one of the business lines in Valmet corporation. It is established on April 1, 2015 when an acquisition of Process Automation Systems from Metso was made and Automation business line was combined with Valmet's financials. In Finland, it is registered as separated legal company Valmet Automation Oy. Globally Valmet Automation had EUR 296 million of net sales and 1708 employees in 2017. Most of the net sales is achieved from solutions and services sold directly to the customers, however, about 10 % of net sales is generated when automation is sold as a part of Valmet's other business lines' project delivery. Automation has operations, at least a sales office, in 30 countries. The most significant areas in terms of the net sales are EMEA and North America, like in the whole Valmet corporation. (Valmet 2018B)

Valmet Automation develops and offers automation and information management systems, applications and services. Valmet corporation has categorized Automation as a stable business. However, Valmet Automation, unlike the other business lines, divides its business into both capital business (new installed base) and services. Automation's wide product portfolio includes, for instance, distributed control systems (DCS), analysers and measurements and quality management systems for pulp, paper and energy industries. (Valmet 2018B) In other words, Valmet Automation's offering varies from projects and smaller capital sales to different types of services. Therefore, Valmet Automation has several business and order types that are processed differently depending on its requirements like invoicing. Valmet Automation's different order types and the order management and invoicing processes are described more closely in the Chapter 4 that includes the current state analysis.

3.3 Research process

The research process of this thesis was planned to follow the general research process of Saunders et al. (2009). They have defined the steps to be: formulate and clarify research topic, review the literature, understand research philosophy and approach, formulate research design, plan and execute data collection, analyze data and write project report and prepare presentation. Generally, process proceeds logically from start to end. However, they argue also that the process should not go only forward, because reflection and revision is important for research process. Yin (2009, p. 4) has simplified the steps of a case study into four major steps: 1) research planning, 2) data collection, 3) data analysis and 4) reporting. This categorization is used to demonstrate the research process of this master thesis in the Figure 9.

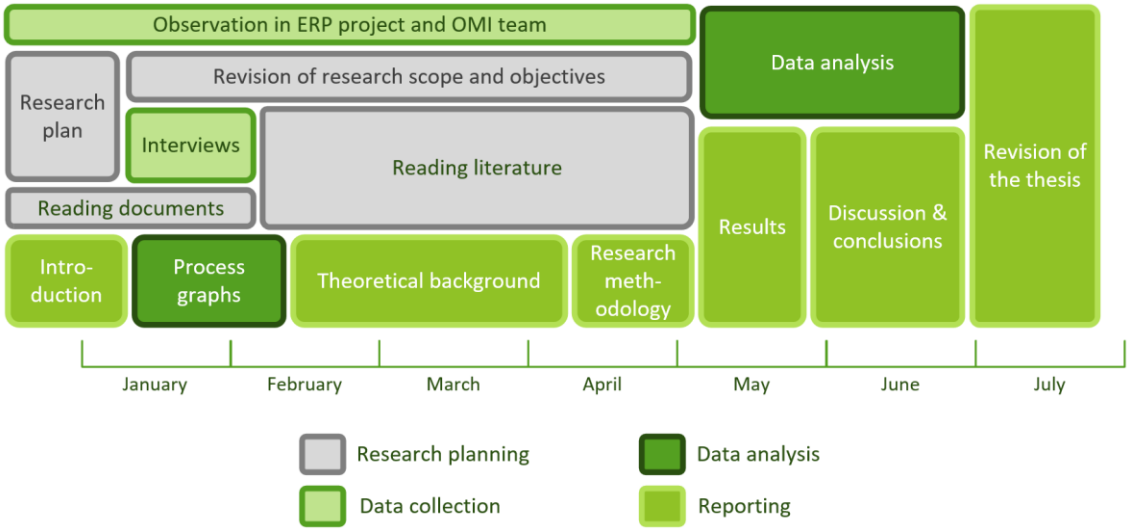

Figure 9. *Steps of this research process*

There are some differences between the planned research process and the one that was actually executed. In the Figure 9, that illustrates the actual research process, the length of the box represents the duration of a certain step. The height of the box demonstrates roughly how much time during the month was used in each step. In this thesis, the research problem and schedule came as predefined from the target company. Therefore, it was quite easy to determine good research questions that were meaningful, realizable and suitable. In other words, motivating, feasible in terms of extent, schedule and data access as well as suitable for master thesis theoretically and practically for the company. (Saunders et al. 2009, p. 22) However, the term "order management and invoicing" is not discussed in the literature. Therefore, the topic had to be linked to the supply chain management relating literature. In addition, the predefined research scope was cut in half in order to fit the extend and schedule of an average master thesis.

The target company had already in the beginning of the project urgent need for quick current state analysis of the order management and invoicing processes. Therefore, the

interviews were mostly conducted before the literature review in order to collect data about the processes as quickly as possible. In addition, some of the data was analyzed already then to create the process graphs and understand the differences between the order types. However, it was quite challenging to draw the process graphs without reading the literature. Saunders et al. (2009, p. 22) have argued that the literature should be explored in the beginning of the project in order to clarify the topic and create foundation to the research. The quickly and roughly made current state analysis was extended to its current state after the theoretical background was written. Some revisions for research scope and objectives were also possible to make quite late in the process, because the research was made with inductive approach. In addition, the project schedule had also quite a lot of time (about one moth) for revision, after the project was already "once completed". The changes and alterations were made based on the comments from professor and other readers of the draft version.

All in all, the research process was logical for organization's needs and enabled the researcher to gain better understanding about organization's business and order types already in the beginning of the project. In addition, the rough current state analysis in the beginning helped researcher to better revise the scope of the thesis and focus on the most urgent challenges in Valmet Automation's order management and invoicing processes.

3.4 Data collection and data analysis

In this thesis, the data about the order management and invoicing processes is collected with two different techniques, *observation and semi-structured interviews.* According to Saunders et al (2009, p. 146), it is typical to use multiple data sources in a case study in order to triangulate the data. Triangulation means ensuring that the data is telling what it is supposed to tell by comparing data from different sources within the same research. In addition, some internal documents, like procedures and instructions in internal database, were also read in order to become acquainted with the functions and processes in Valmet Automation. However, most of the documents were too general or somehow irrelevant for understanding the order management and invoicing. For instance, order management and invoicing process was typically covered only with one step in a process graph or discussed from supply chain perspective. Therefore, documentary analysis was not really conducted and documentary reading was not a data collection procedure.

3.4.1 Observation

This study includes participant observation that provides qualitative data. Saunders et al. (2009, p. 293) argue that observation can be either participant observation or structured observation. Observation involves systematic observation, recording, description, analysis and interpretation of people's behavior. According to Gill and Johnson (2002, cited in Saunders et al. 2009, p. 293), there are four different roles for researcher in participant

observation. The roles are divided based on two features: concealing of the identity and participation of the observer. The roles of the researcher are introduced in the Figure 10.

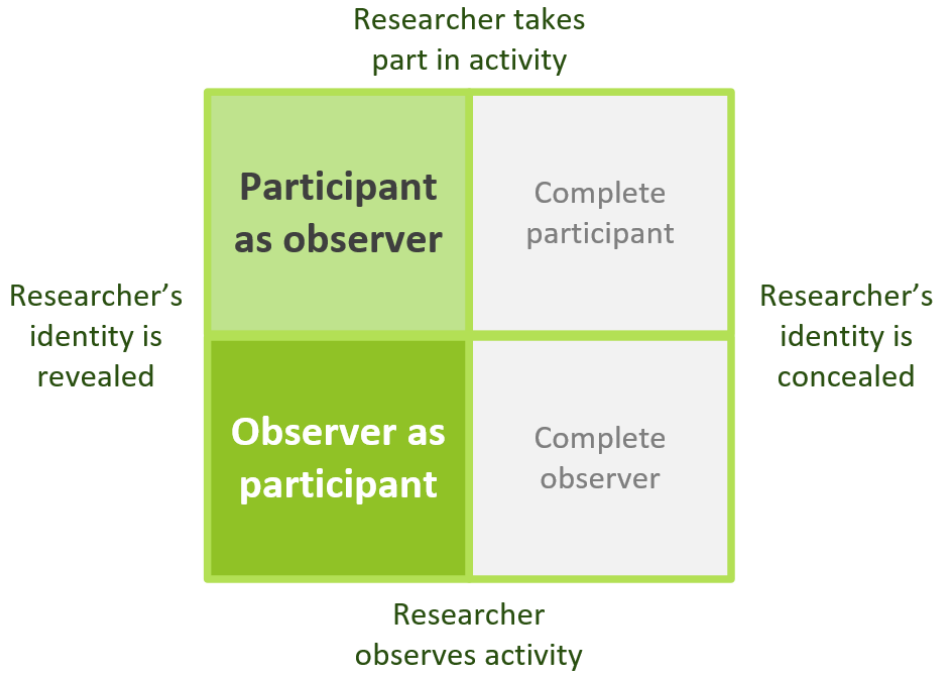

Figure 10. *Roles of researcher in participant observation (adapted Saunders et al. 2009, p. 293)*

In this thesis, the researcher's identity is revealed and the activities are just observed, therefore, the role is *observer as participant.* The observation is conducted while working as a thesis worker in the order management and invoicing team in Valmet Automation Oy. As a team member researcher participated in regular team meetings, where difficult challenges and exceptions that are not covered with the standard process, were discussed. This observing covers mostly only project orders that are the main task of this team. Observation enables the researcher to understand the process better and gain some tacit knowledge about different challenges and informal methods. It is also very practical data collecting method if the researcher is working in the target company. However, in order to get reliable and high-quality data the observation might require a long period of time. The technique generally provides a large amount of data that might be difficult to categorize and analyze later. In addition, the situation might pose ethical dilemmas, difficulties to adapt the role or affect researcher's objectivity. (Saunders et al. 2009, p. 299)

Some of the observation is performed in the role of *participant as observer* while working in the ERP implementation project as an implementation owner of sales and invoicing stream. In the ERP project, observations include all order types, because of the collaboration with other functions like service delivery and supply chain. Observation was conducted in meetings, trainings, workshops and informal discussion within the on-going project. The roles in right (complete participant and complete observer) involve researcher's identity concealed. Saunders et al. (2009, p. 293) argue that it is a significant

advantage for research's reliability, because the observation does not impact to the research subjects. However, the revealed identity, like in this thesis, might be ethically less problematic.

In this thesis, the participant observation was a good technique to collect the data and make deeper the understanding about organization's current state. Both the researcher and Valmet Automation (the organization and its employees) were interested in the research topic. Therefore, order management and invoicing team eagerly took the researcher as part of their team and were really open about their work: tasks, challenges, working methods and solutions. In addition, the researcher's work contribution was found out to be useful in the ERP implementation project.

3.4.2 Interviews

Most of the interviews in this thesis are semi-structured interviews, where a list of themes and questions is planned to be covered. However, in semi-structured interviews some questions may be skipped or then discussed very deeply with additional questions. The main objective for the interviews was to get understanding about order management and invoicing processes. Therefore, some of the interviews became more like unstructured interviews that have no predefined list of questions, but only a clear idea about the objective (Saunders et al. 2009, p. 321). Actually, Saunders et al. (2009, p. 318-320) have stated that interview is a general term for several types of interview. A summary of the different interviews of this study is presented in the Table 2.

Table 2. *Summary of the interviews in this study*

Interview	Duration	Participant(s)	Topic(s)	Order management and invoicing		
				Main task	One task	No tasks
1	65 min	Coordinator	Main projects	x		
2	75 min	Coordinator	Main projects	x		
3	50 min	Controller	Finance			x
4	45 min	Specialist	Supply chain			x
5	50 min	Assistant	Engineering recharging		x	
6	60 min	Assistant	Logistics project		x	
7	55 min	2 Project managers	VAR		x	
8	35 min	Coordinator	Product sales	x		
9	40 min	Assistant	Service agreements	x		
10	35 min	Assistant	Trainings		x	
11	50 min	Project manager	Demand service		x	
12	40 min 55 min	OMI senior manager	Spare & Repair Factory-factory	x		

The interviews were conducted already in the beginning of the project. First there were a few informal conversations, like interviews, in order to get the basic knowledge about research problem and objectives. After that there were 12 interviews with people who process orders as one of their daily tasks or as a main task. Two of the interviews were with people from other functions that does not handle order management but are closely involved with the results of the process. The purposive sampling, that is typical for case study research, was used to select the interviewees. Purposive sampling enables control over the sample content and, therefore, better fit for the objectives. (Saunders 2009, p. 237-240) The interviews were held face-to-face in Finnish at Valmet's office. Most of the interviews were one-to-one interviews about a certain order type. However, one interview was a held as a pair interview and another interview included more than one order type.

The planned semi-structured interview outline that was used in the interviews, is presented in Appendix A. The figure was built according Saunders et al (2009, p. 338) instructions. The themes covered order management and invoicing as a term, process and a function. However, the last part (order management and invoicing as a function) was rarely discussed, because the focus was in the process. In addition, the interviewees were asked to introduce themselves as a 'warm up question' and the discussion ended up with possibility to ask questions or comment freely about the subject. However, semi-structured interview enabled the interviewees to have great opportunity to lead the discussion also during the interview (Saunders et al. 2009, p. 321). Very extensive notes were written during every interview. In addition, most of the interviews were audio-recorded in order to complete the notes. The transcribing was conducted roughly, however, all the sentences and points were recorded to electronic documents.

In addition to the interviews, there were two interview-like occasions after the actual interviews. These "workshops" were held for main projects and product sales after the process graphs were drawn. In the main projects workshop, the three coordinators checked the process graph in order to improve and complete the information. The product sales workshop was a bit bigger occasion with two coordinators, two financial controllers and OMI senior manager. The process graph was also completed in this occasion; however, the main objective was to compare product sales between Kajaani and Tampere office.

3.4.3 Data analysis process

The objective of the interviews was to find out how a particular order is processed in order to draw an exact process graph for each order type. In addition, the objective was to collect information about different processes to analyze and compare them to each other in order to improve and harmonize them. The data analysis was performed in two parts: 1) process graph drawing and 2) current state analysis. The data analysis process is introduced in the Figure 11.

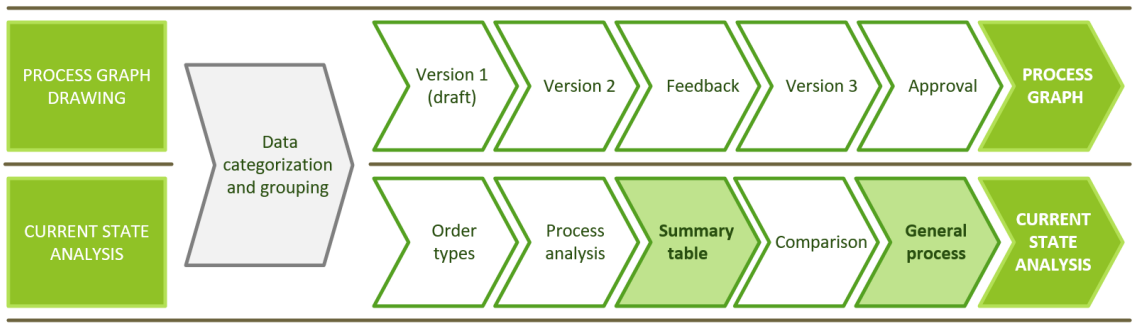

Figure 11. *Summary of the data analysis process*

In the first part, the data from a certain interview was divided into several groups depending on the phases and roles of the process. After that few versions of the process graphs were drawn. Typically, the first version, the draft, was made to the paper and the second version with an application (Microsoft Visio) to the electronic form. The drawing was an iterative process were feedback was generally asked from the interviewees after the second version. The third version was typically already the completed version that was then approved by the order processors. However, in some cases the iteration process was longer, because the iteration was conducted until the process graph was complete. For instance, the main project order management and invoicing process graph (Appendix B) took approximately five iteration rounds with meetings and informal discussion before it was ready. The ready process graphs were stored as current procedures and process descriptions in Valmet Automation's internal database. In addition, they were used in the ERP implementation project.

In the second part, all the data was analyzed together in order to compare it and make generalizations. The main phases and roles, introduced in the first part, were used in the analysis. However, they vary a little bit between the order types. Therefore, the order types had to be determined and processes analyzed first as their own. After some recategorization, a massive excel table was made for the comparison. Comparison means finding similarities or unique features in the processes. The summary table was divided into separated sections that were used as the basis for the general process. These sections are introduced as several smaller tables (Tables 3-7) in the current state analysis in the Chapter 4. Summary table and general process are highlighted in the Figure 11, because they are not only phases of the current state analysis but also results of analysis.

4. CURRENT STATE ANALYSIS OF ORDER MANAGEMENT AND INVOICING IN THE TARGET COMPANY

This current state analysis is written based on the data from interviews and observation. The main results are the ten process graphs that demonstrate the current state of every order management and invoicing process in Valmet Automation Oy. These process graphs are really detailed and include internal information, so they are not presented in this thesis. However, one simplified process graph of main projects is introduced and discussed as an example. In addition, the analysis defines that general process includes four phases: receiving, entering, invoicing and closing. The analysis is completed with the summary table that enables better comparison between the 19 different order types. During the analysis, some challenges that concern all processes or certain order types or order management and invoicing in general came up from the data. In addition, six improvement ideas to address the challenges were discussed in the data.

4.1 Overview

Valmet Automation Oy has different kind of order management processes that vary depending on both business and order types. Compared to Valmet's other business lines, AUT operates in both capital and service businesses (Valmet 2018A). According to the interviews, there are some basic steps that are executed in every order management and invoicing process in Valmet Automation Oy. All these general steps, receiving, entering, invoicing and closing, include multiple tasks that are similar in every process. However, the execution of the tasks might vary depending on the order type or order processor. The general order management and invoicing process is represented in Figure 12.

Figure 12. *General order management and invoicing process in Valmet Automation Oy*

According to the interviews, order management and invoicing process in Valmet Automation Oy starts always with *receiving the order*. Order might come from the end customer via e-mail directly or after an offer or as a result from long negotiations. Therefore, some of the orders are received by the order processor itself and some by the sales/service manager. In this thesis, ***order processor*** *is an employee that enters the order into the ERP*

system and in some of the order types also manages the invoicing. Order processors are titled, for instance, as project order management coordinators, spare part coordinators, assistants, service managers or logistics coordinators. Valmet Automation Oy receives orders also from other AUT units with internal purchase orders (IPO) or from Valmet Technologies Oy with purchase order (PO). In the receiving phase, the main task for order processor is to confirm that he/she has all necessary information available for order entering.

In all the cases, it is important to understand what the customer wants and to specify the order as precise as possible. However, according to the observation it is quite challenging in automation business, at least with projects. In the ERP project's workshops, automation industry was defined as very flexible and customer-oriented business. Therefore, many people agreed that customers make changes to their orders during the delivery process, also after the factory acceptance test. Factory acceptance test (FAT) is the first time when a customer sees the system as a whole at the manufacturer's site before the delivery and installation. The main objectives for the FAT are 1) to verify that applications have been done according to given basic information and 2) to minimize the changes and modifications during the on-site phase. (Valmet internal AUT procedures 2018)

Some people stated that it is an "industry standard" or basic customer service to enable customer make changes. Sales managers are not even able to specify the order in the sales phase, because commonly the engineering is always executed after the sales order is entered. Some people have claimed that in most of the main projects, the bill of materials (BOM) made by the sales manager (before the order entry) matches poorly, only 10-20 %, to the actual delivered BOM made after the delivery. However, this claim is not researched within the company, so the actual number is not known for sure.

Order entering phase includes two main tasks, identification ID opening and sales order entering. In this thesis, ***identification ID*** *is project number, standing number or site ID, that is used for tracking the order in ERP and other systems.* Project number is typically opened by the order processor e.g. project order management coordinator or project assistant. However, site ID is site/area/country-based number that is previously opened in the customer relationship management system. Most of the orders are entered manually to identification ID by the order processor. Some of the orders might have been entered to the ERP already in other AUT unit by their order processor, therefore orders are not opened manually to ERP in VA anymore. In these Lean-to-Lean (L2L) or eIPO cases, VA Finland's sales orders are created or copied from the purchase order the other AUT unit sends. In addition, the sales order can be copied directly from the existing offer that is originally made by, for instance, spare coordinator to the ERP system.

In all cases, order processor must confirm that all necessary information, for instance, invoicing and shipping details, customer's order number and Value Added Tax (VAT) code, are correctly entered in ERP. If IPO from other AUT unit is needed for the order,

order processor must wait for it before adding order rows and activities. In this thesis, ***activities*** *are data in the ERP system that is used for business purposes to follow up sales and costs by the product groups or products.* The costs are reported by cost types, for instance, hours, travel expenses and hardware. The activities give also the business type for the costs. In addition, payment and delivery terms are checked in the order entering phase, because some of the information might be needed later with the invoicing. After the order is entered to the system order confirmation is sent to the customer and the execution of the order starts in other functions like operations, service or supply chain.

The main tasks of the *invoicing phase* are to create, book and send the invoice. In Valmet Automation Oy, most of the order types are invoiced by the POMI team in Tampere or by the logistics coordinators in Kajaani. However, according to the interviews, there are also other ways to handle the invoicing. For instance, some of the order processors create invoice proposals for the POMI team, so then the team's task is just to check, book and send the invoice. In addition, with some periodically invoiced order types the system can create the invoices automatically for the order processor to confirm. Some of the order types are invoiced by the payment installments, after the order or payment is marked 'ready for invoicing' and others after the delivery. Before sending the invoice, the person responsible for invoicing, must confirm especially the VAT code and if the payment terms include something special, for example, guarantee, letter of credit or take over certificate. The correct invoicing prices are confirmed already earlier in the order entry phase or by the person who made the invoice proposal. After the invoicing in completed, the payment installment or the whole order is marked automatically as 'invoiced'.

Order proceeds to the *order closing phase* after the whole order is invoiced and delivered. According to the interviews, this phase varies a lot of depending on the order type. Sometimes, a project closing form from a project manager is needed, however, with smaller orders the closing is quite simple and automatic. Even though the order processors do not have that much tasks in this phase, it is still a critical phase in order management and invoicing, because after that the customer order is "ready". In closing phase, financial controller makes necessary financial activities for the order. Basic rule is that large orders need more attention and the smaller ones hardly any. In some project cases, controller makes also commission calculations and POMI team sends the internal project commission invoice for the AUT unit, in order to show how much commission the AUT unit receives. In addition, controller closes the project number or other identification ID in ERP and other systems, if needed. Some of the (standing) order numbers remain open in ERP, because they are used several times. In addition, the order-specific activity codes remain open but should be closed by the order processor later, typically after 6-12 months. Project activities, on the other hand, are general activities that are closed automatically simultaneously with the project number.

This general process gives a rough understanding about the current order management processes in Valmet Automation Oy. However, there are many details that vary between

the different processes determined by the business and order types. Based on the interviews, Valmet Automation has three main categories for business type: projects, service sales and product sales. This categorization differs from the generally used one, where orders are either capital sales or service sales. Based on the interviews, 19 different order types are identified. However, some of the order types can be merged together, because they are demonstrated with 10 various order management and invoicing process graphs. The process graphs contain a lot of detailed information about the processes, so they are provided only for Valmet Automation and not shown in this thesis. In order to understand the content of the process graphs, a simplified version of the order management and invoicing process of the main projects is provided in the Appendix B. The different order types and their process graphs are listed in the following Table 3.

Table 3. *Business and order types in Valmet Automation Oy*

Business type		Order type	Process graph category
CAP + SER	PROJECTS	End customer projects Pass-through projects Valmet pass-through projects	Main project
		Engineering recharging projects	Engineering recharging (subproject)
		Logistics projects	Logistics (subproject)
		Cabinet subcontracting Internal component sales	Factory-factory (subproject)
CAPITAL	PROJECTS	VAR projects	VAR project
	PRODUCT SALES	End customer sales Internal Sales Trials	Product sales
SERVICE	SPARE AND REPAIR SALES	External sales case AUT internal sales	Spare and repair sales
	DEMAND SERVICE SALES	External sales case AUT internal sales “Engineering recharging”	Demand service
	SERVICE AGREEMENTS	End customer sales	Service agreements
	TRAININGS	Trainings	Trainings

There is a difference with the category level of the business and order types in Table 3. The business types (projects, product sales and service sales) are marked in different columns in order to demonstrate the difference to the capital/service split. Valmet Automation has divided service sales into four groups, spare and repair sales, demand service, service agreements and trainings that are the business types themselves. However, in this

study this classification is used as the split for order types, because it is difficult to categorize service sales in any other way. Product sales and projects, on the other hand are categorized and identified by the order types presented in the table. The process graphs are color-coded to in the table with ten distinct colors. Capital orders are marked yellow, service orders blue and projects that include both businesses with shades of green.

Order management and invoicing processes differ from each other, because of the distinct business types demand dissimilar actions during the processes. In addition, many working methods have been developed separately for different business needs. According to the interviews, some tasks might be slightly old, outdated or complex and therefore even inconsistent with Valmet Automation's common instructions. Main projects, which form most of the revenue, are managed carefully by the POMI team while subprojects or service orders are entered not so systematically by different order processors. Therefore, the order management and invoicing process is not yet so clear for some of the order types. In addition, some processes might be quite special, like product sales that is a separated process executed only in Kajaani supply center. The different order management and invoicing processes are discussed more closely in following subchapters.

4.2 Order management and invoicing of the projects

According to the interviews, Valmet Automation Oy deals with eight different project order types, that are demonstrated in five process graphs. In addition, project order types can be categorized into three groups: main projects, subprojects and VAR projects. In Valmet Automation, ***project*** *is an order with over 100 000 euros of customer contract price and time frame from order to final acceptance more than 4 months. Project includes also project manager, budget, schedule and clear work breakdown structure.* (Valmet internal AUT procedures) All the project order types and their categories are listed already in the Table 3. However, the project order types are more closely determined as follows.

4.2.1 Project order types

Valmet Automation has eight different project order types, as introduced already in the Table 3. The different project order types can be merged into main and subprojects. In this research*, a main project* is an end customer project that is sold to the end customer directly or as a pass-through project. *Subprojects*, on the other hand, are smaller internal projects performed within a main project that is booked in another unit to deliver the main project to the end customer. In these subprojects, supply chain functions, engineering or project management is executed in Finland. For clarification, main projects booked in Finland require also, for instance, engineering, supply chain and production. However, these tasks are internal costs marked directly to the project that do not require invoicing. Therefore, main projects in Finland do not include the subprojects in Finland. In addition to the main and subprojects, *VAR projects* are discussed as an own special project type.

In order to understand how the subprojects relate to the main projects, it is important to introduce some general details about the supply chain in Valmet Automation. Globally the company has sales units in 33 countries but only four supply centers in Tampere, Kajaani, Gliwice (Poland) and Mumbai (India). Supply centers provide all the products and components as well as perform all cabinet subcontracting in Valmet Automation. In addition to the actual supply centers, there are some supply center related actions in Shanghai (China) that has also been a supply center. If the main project is booked in other AUT unit and it also stays there, unit usually needs to order some of the subprojects with a purchase order from supply center in Finland. If the assembly is executed in Finland, the internal purchase order is entered as logistics project in Finland. However, if the assembly is executed in another AUT unit, in another supply center, some purchases from Finland are usually still required as internal component sales. If the unit requires some engineering or project management labor from Finland the order is engineering recharging project. Some projects in the units can also include more than one subproject. In order to understand how the project order types and order management and invoicing processes are linked to each other, a summary of projects is provided in the Figure 13.

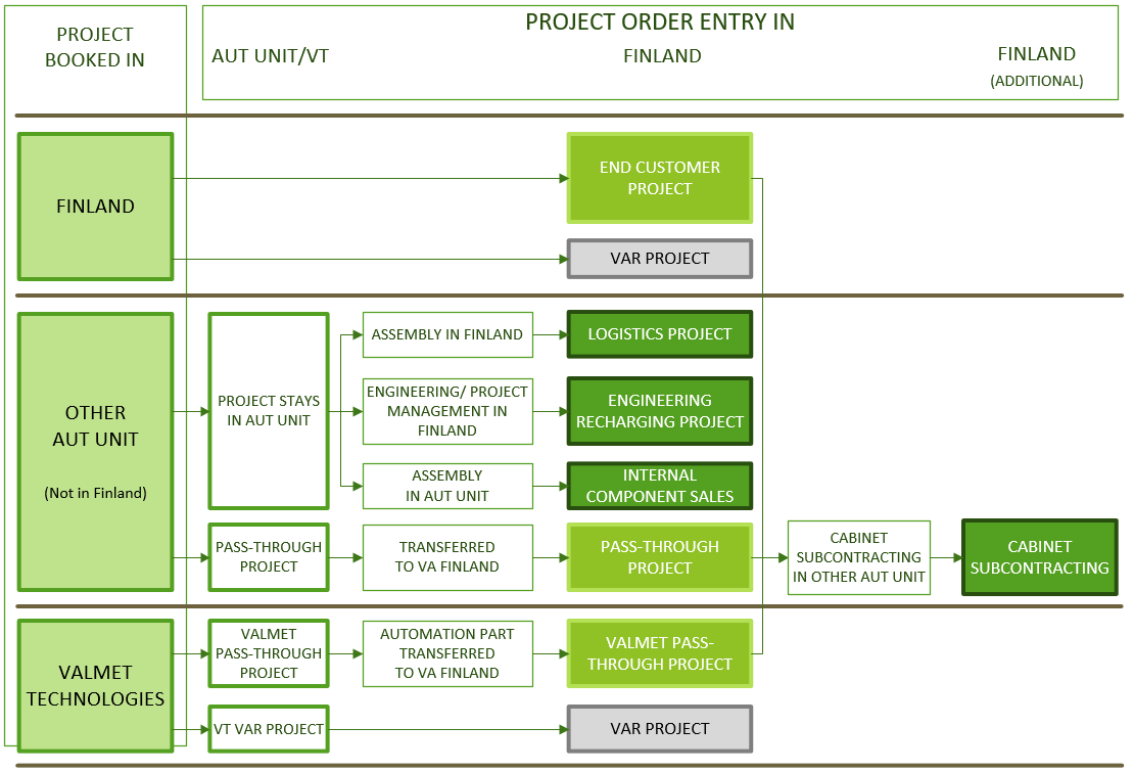

Figure 13. *Capital and service projects in Valmet Automation Oy*

Valmet Automation Oy's projects can be divided also into the groups by its booking locations. Projects can be booked 1) directly in Finland, 2) to the AUT unit and then as a pass-through in VA Finland or 3) to the Valmet Technologies Oy (VT) and then as a Valmet pass-through or VAR project also in Valmet Automation Finland. If the project is booked directly to Finland, the project's customer is always the actual end customer

and order entry for the main project is executed in Automation Oy. In the other cases, VA Finland's customer is the other AUT unit or Valmet Technologies depending on where the actual order with end customer is entered.

In the Figure 13, the booking locations are illustrated in left as their own sections that divide the figure into three. The next two "columns" determine if the project is a pass-through project or VAR project and what kind of needs there are from VA Finland. The next "column" in the middle demonstrates the main message of this figure: what is the project order type for a certain case. In the figure, main projects are marked with light green, subprojects with dark green and VAR projects with grey. The right part of the figure represents that any of the main projects can include additional cabinet subcontracting project order entry, if the cabinet is subcontracted in another AUT unit. Cabinet subcontracting differs from the other subprojects, because it is an additional subproject for main projects booked directly or as a pass-through to VA Finland. The other subprojects relate to the projects that are booked in the units. Execution of a main project booked directly or as a pass-through in Valmet Automation Oy in Finland might also require subprojects, for instance engineering, from another AUT unit. However, these orders are not showing in the Figure 13, because they are excluded from the scope of this research.

There are this many different project types in order to deliver different projects to different customers. Therefore, the projects also have different content: hardware, software or labor. Labor refers basically to engineering or project management. A project might also contain an entire AUT system that is delivered to the customer as a whole. The details for different projects are also introduced in the following Table 4.

Table 4. *Project details*

Order type	Order content	Customer	Booking location
End customer Pass-through Valmet pass-through	AUT system	End customer AUT unit Valmet Technologies	VA Finland Unit + VA Finland VT + VA Finland
Engineering recharging	Labor	AUT unit	Unit + VA Finland
Logistics	HW + SW	AUT unit	Unit + VA Finland
Cabinet subcontracting Internal component sales	HW HW + SW	AUT supply center	VA Finland (+ Unit) Unit + VA Finland
VAR	HW + SW (+ Labor)	VAR partner	(VT +) VA Finland

HW = hardware, SW = software, VA = Valmet Automation Oy, VT = Valmet Technologies Oy

There are three kinds of main projects in Valmet Automation Oy: end customer projects, pass-through projects and Valmet pass-through projects. Main project's order management and invoicing process is shown in the Appendix B. **End customer project** is a typical main project between end customer and Valmet Automation Oy. Even though the

order is booked directly to Finland, is not always executed in Finland. The supply center for the project is typically determined by the product type. The project management and engineering, on the other hand, can be conducted by Finnish or foreign Valmeteers. Even though the project is close to Finland, it is not always executed by the Finnish project manager, project group and supply centers. In this kind of global project-based firm, the resources are allocated globally based on various criteria, e.g. which resources are available. If the project order is from somewhere else, but booked directly to Finland, it might be executed by local/closer Valmeteers with subproject orders that AUT Finland does to the units. However, this kind of subproject orders from Finland to another AUT unit and the order management in AUT units is excluded from the scope of this study.

The **pass-through projects** are projects that are originally booked somewhere else than in Finland and transferred with internal purchase order to VA Finland with same total contract value. Therefore, the end customer order is located in AUT unit. In this case, VA Finland's internal customer is the local unit, which will gain 0 % gross margin from the project, but will be compensated later with commission. This internal project commission is invoiced by POMI team. Commission is like a credit invoice, where the AUT unit gains money. Pass-through model was implemented in Valmet Automation, because most of the AUT units have different and simpler, ERP systems than VA Finland. This way the work of project managers and accounting is much easier, the system contains less mistakes and project management resources can be used from other legal entities. **Valmet pass-through project** is a project where the customer, Valmet Technologies Oy, transfers only the automation part of their customer order by purchase order to VA.

Valmet Automation has also three kinds of subprojects: engineering recharging projects, logistics projects and factory-factory projects. **Engineering recharging project** is a subproject, where engineering and/or project management is ordered from VA Finland, to perform a main project, that is booked and executed somewhere else than in Finland. **Logistics project** is a similar subproject, where systems (hardware and software) are bought from Finnish VA supply center, to perform a main project, that is booked and executed somewhere else than in Finland. These two projects types are not used with pass-through projects. **Factory-factory projects** are DCS assembly projects bought from another supply center unit than Finland (AUT India, AUT China or AUT Poland), that buys the components (and licenses) from Tampere supply center, because the intellectual property rights are registered in Valmet Automation Oy in Finland. These projects are separated into two different processes. In *cabinet subcontracting projects,* DCS assembly is bought from India/China and the main project is booked (directly or as a pass-through) to Finland. In *internal component sales,* DCS assembly is bought from Poland/China and the main project is booked somewhere else than in Finland.

One of the project types differ from the others, because VAR projects are special projects that are sold with different contracts to partners and executed solely without any subprojects. **VAR projects** are value added reseller projects between VA Finland and special

VAR partners (Valmet Technologies, Valmet Automation AB and some energy & process systems (EPS) customers) that buy the products to use them as part of their own sales. These projects include only a little engineering and no project management by VA Finland. In addition, VAR project is the only project type, that contains projects mostly only from capital business. Therefore, VAR projects are marked separately with the yellow color to capital business in various tables.

4.2.2 Comparison of the project order types

As stated before, there are many differences in the order management and invoicing processes between the project types. The orders are entered differently to various project numbers by several order processors. In addition, the person who opens the project number can be different than the order processor who enters the actual sales order for it. This difference is typical with the global project numbers, that are opened already in the AUT units and standing numbers that do not require opening. Most of the orders are entered manually to ERP system. Only the factory-factory projects are special, because the orders come directly to the ERP system as Lean-to-Lean orders. Lean is name of the ERP system. In addition, some of the project types might require an IPO for the sales order entry. The details about different order entry characteristics depending on the order types are listed in the Table 5.

Table 5. *Order entry and invoicing details for projects in VA Tampere*

Order type	Order entry by	Project number	Order entry method	IPO	Invoicing by	Invoicing prices	Installments
End customer * Pass-through * Valmet pass-through *	POMI	Main	Manual	- IPO -	POMI	Contract value (- commission) Agreed prices	Yes
Engineering recharging (*)	Assistant	Global Sub (Standing)	Manual	IPO	POMI	Transaction based + mark-up	Yes, special
Logistics *	Logistics coordinator	Global Sub	Manual	IPO	Logistics coordinator	Transfer prices	No
Cabinet subcontracting Internal component sales	Spare part coordinator (enrichment)	Global	L2L	IPO	Shipping department	Transfer prices	No
VAR	Order processor	Standing Main	Manual	-	POMI	Agreed prices	No

* = Project orders entered also in Kajaani supply center, L2L = Lean-to-Lean

First column in the Table 5 determines the project order type, next four describe the order entry details and last three concern the invoicing, because also invoicing prices and methods are different depending on the order type. In addition, the project types have different sales order prefix codes in the ERP system. These codes determine how the order is processed within the system, for instance, who does the invoicing. The codes themselves are not important for this study, so they are left out from the table. Actually, this table includes only the main points of the summary table provided to Valmet Automation Oy. For instance, the information that all sales orders of the projects include the standard product group based structure for the activities (even though the order types are otherwise quite different), is excluded.

According to the interviews, the project can be opened for a main project number, global project number, subproject number or standing project number. These are written only with short forms in the third column of the table. Main project number and global project number are actually quite similar. Main project number is a project number opened by POMI team in Finland. Typically, it is used only in Finland. However, it can be also used globally, if needed. Then the main project number has to be recategorized for a global usage in ERP system. Global project number, on the other hand, is opened in another AUT unit but to utilized also with the subprojects in Finland. Global project number is simultaneously the main project number for the project in project's original unit. Subproject numbers are project numbers from certain serials to be used with subprojects, that have no global project number to used. Based on one interview, some of the engineering recharging projects are opened to the standing project numbers, as marked in the table. This method splits the opinion, because in another interview the senior manager was disagreeing and told that these (engineering recharging related) standing numbers should not be used and rather to be removed from the system. Probably the best way to deal with small engineering recharging costs and invoices will be discovered later, after some discussion.

The information about different invoicing prices and installments are also marked in the Table 5. Basic rule is that the main projects include payment installments and subprojects do not. However, engineering recharging might be invoiced also by the installments, if enough costs are piled up during a certain period of time. Only end customer and pass-through projects are invoiced with the total contract value. In addition, the pass-through includes also commission invoicing for the AUT unit. All the other project types are invoiced with special prices that are agreed by the both parties. Valmet Automation has different invoicing methods and ways to determine the transfer price, because the business environment varies between countries. One interviewee summarized the situation: *"Invoicing is not that simple, not even with the [main] projects. For instance, Poland requires special VAT-invoices, India have specialties with customs and Brazil with taxes. In addition, I think that our supply center in Poland have caused us a lot of extra work."* Another interviewee added, that some of the invoices are so special that they cannot be

printed out from the ERP system correctly. Therefore, some invoices have to be modified manually with a PDF editor. Sometimes also after a project manager or asales manager or a customer asks for the changes.

All these project order types are used in Tampere supply center. However, Kajaani supply center manages only the main project orders and logistics project orders. According to the interviews, also some engineering recharging projects might occur in Kajaani. However, in Kajaani, all the order management and invoicing of different project types is conducted by the same logistics coordinators. Therefore, Kajaani supply center is marked to the Table 5 only with the stars in the first column. POMI team occurs most in the table, because it is the main order management and invoicing team with the projects. For example, some of the project orders are entered with different order processors but invoiced by the POMI team, as marked in the table. In addition, global project numbers in cabinet subcontracting are opened with POMI team even though spare part coordinators (that are marked in the table) perform some order enrichment to the "ready" Lean-to-Lean orders. POMI team and its responsibilities are more closely introduced in following subchapters.

4.2.3 Project order management and invoicing team

Order management and invoicing of the projects is mostly performed by the project order management and invoicing (POMI) team. POMI team is the main part of Valmet Automation's order management and invoicing function (OMI) that has been recently (beginning of 2018) separated as an own function, apart from supply chain in operations. POMI team consists of three project order management coordinators located in Tampere. The OMI function, on the other hand, includes also a senior manager that focuses on developing the new function both in Finland and globally. According to the interview, OMI function should cover all order management and invoicing processes in Valmet Automation globally. Currently there are no global and harmonized methods or procedures for any of the order types yet, because various ERP systems and local requirements have caused differences. Therefore, OMI function focuses first on the processes in Finland and then harmonizing the them globally. In this thesis and in practice, OMI and POMI team are still kind of synonyms and relate mostly only to the works conducted by the three ladies in POMI team.

POMI team handles basically all the end customer and pass-through projects in Valmet Automation Oy. According to an estimation of one interviewee, they cover almost 80 % of global transactions in project sales. However, also logistics coordinators in Kajaani manage and invoice some main project orders that include only products delivered from Kajaani. POMI team covers also the invoicing of engineering recharging and VAR projects and factory-factory pass-through projects from India. Other factory-factory and logistics projects are invoiced by other order processors in service or supply chain. Based on the interviews, *sales order entry* and *sales invoicing* that include both internal and

external sales are the main responsibilities of OMI. All the responsibilities of order management and invoicing in Valmet Automation Oy are introduced in the Figure 14.

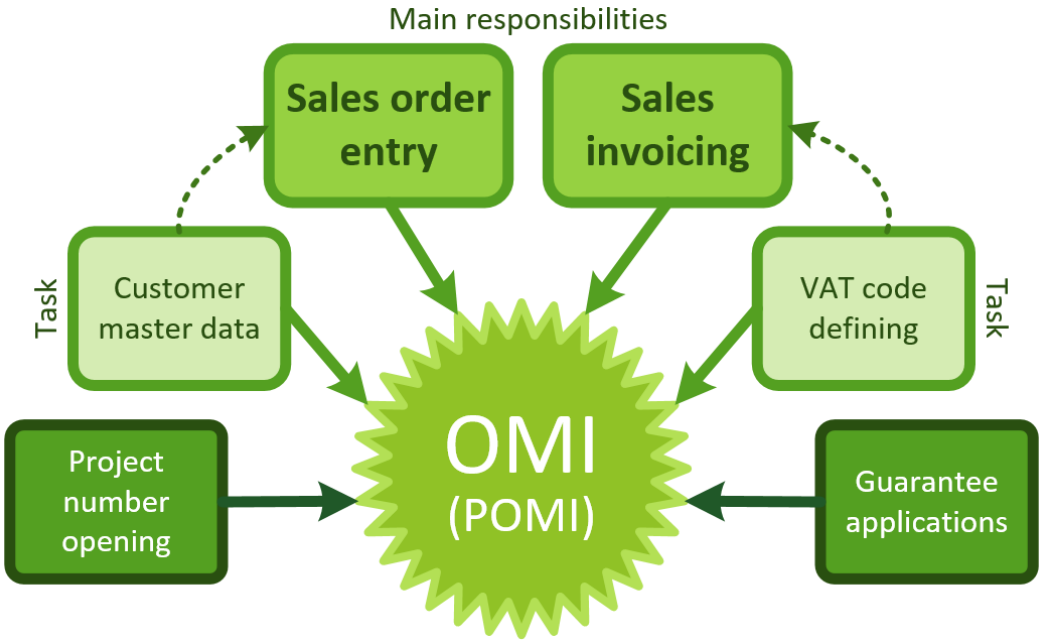

Figure 14. *Tasks and responsibilities of order management and invoicing function*

All the responsibilities represented in the Figure 14, are valid for the POMI team also. In addition, the responsibilities, except *VAT code defining* and *customer master data* opening and enrichment that are tasks themselves, include several tasks. These two tasks that could also be included in the main responsibilities, are so important that they are highlighted as separated tasks in the figure. In addition, the other two responsibilities capital and service *project number opening* and bank and corporate *guarantee applications*, that are marked with darker green, are not valid for other order types than projects. However, if the responsibility *project number opening* is defined to include also site IDs, then it is valid not only for service projects, but for all the service order types. In the interviews, one of the project management coordinators defined also letter of credit as one of the four main tasks of the POMI. Therefore, it is included into the discussion of the order management and invoicing process. All the responsibilities are introduced more closely in the following Subchapter 4.3.

4.3 Example of order management and invoicing process

Order management and invoicing processes of all the project order types are demonstrated as own process graphs given for Valmet Automation Oy. However, only a simplified version of the process graph of the main projects is introduced as on example in this study (Appendix B). Therefore, the other project order types are not discussed in detail. This example of the main project order management and invoicing process is just a basic version of the typical process. Therefore, it does not cover all the exceptions and challenges with some AUT units. For instance, supply centers in Poland and India and orders from

Poland, Russia or Brazil require special instructions and methods that are not discussed in this thesis. One interviewee commented that *"It is nice that you try to make this process graph of our work. However, I think that it is impossible to squeeze in all the exceptions into one process. Currently we have like five or six different processes and more are explored all the time when our knowledge about this function increases."* The tasks in the main project order management and invoicing process are highlighted in the Figure 15.

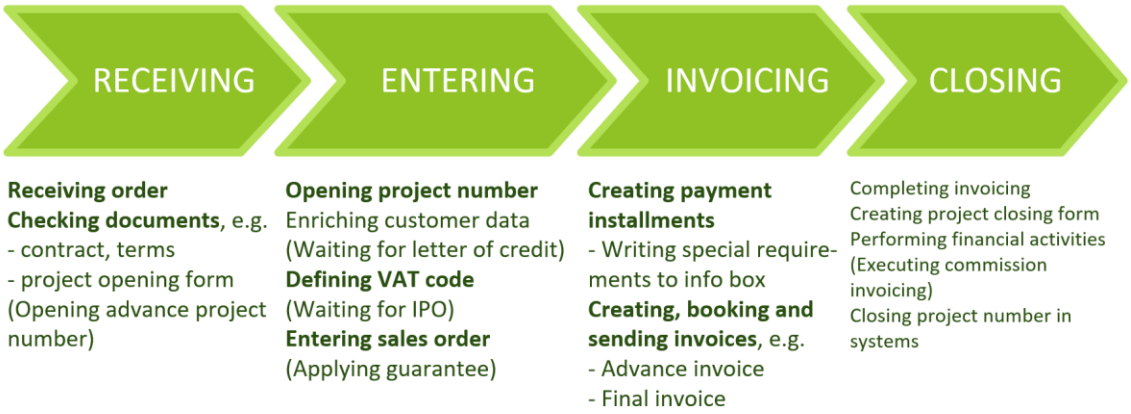

Figure 15. *Order management and invoicing process of main projects in Valmet Automation Oy*

Order management and invoicing process of the main projects is like the general process, but much more detailed. The different tasks are divided into the phases of the general process. In the Figure 15, the tasks in the brackets, are optional tasks that are not required for all main projects. Order management and invoicing process of main projects is mainly executed by the POMI team. The other roles in the process are customer, sales, project manager, financial controller and supply chain. Customer can be either actual end customer or AUT sales unit or Valmet Technologies. Sales, on the other hand, refers to the sales function in Valmet Automation Oy or other AUT units. In addition, supply chain that delivers the projects, is left out from the Appendix B, because it is just an internal step in project execution.

Customer order initiates the receiving phase in the main project order management and invoicing process. Usually it is a result of sales activities, such as opportunity identification, customer relationship creation, proposal presenting and negotiations, performed by the sales manager in Finland or in another AUT unit. Therefore, the sales managers are a critical link between the customer and order processors. Sales managers create a project opening form and confirm that the sales card is marked as 'won'. In addition, the contract has to be signed or the offer has to be accepted with a customer order. After that the sales manager informs POMI team about the new project case and sends over all these documents that are needed for project order entering. Valmet Automation Oy receives orders also from other AUT units with internal purchase orders (IPO) or from Valmet Technologies Oy with purchase order (PO).

According to the interviews, there has been some difficulties in the cooperation of sales function and POMI. Project management coordinators have struggled to get the correct information and all the documents from sales managers. One interviewee stated that *"It is very simple to open a project number and enter an order into to the system if all the information and documents are available. However, in most of the cases sales managers forget to deliver some of the necessary documents. For instance, the contract might be without signatures or the contract value does not match to the value in the sales card. This requires a lot of unnecessary work, time and e-mails."* Therefore, it is important that the POMI team checks and double checks the documents. The main three things that they must confirm are: 1) the price in sales card and contract/order match, 2) project opening form includes all information and 3) the order includes Valmet's standard sales and delivery terms. If something is incorrect, the project number cannot be opened. Therefore, POMI team must ask the sales managers to update and complete the information.

Sometimes the project execution (for instance engineering) should be started before all the required documents are ready. Therefore, it is possible to open an advance project number with product line vice president's special permission. After the sales manager has asked and received the permission, it is possible to open the project number. However, it is still not possible to create a sales order for the project number before all the typically required documents are delivered.

After the order management coordinator has all necessary documents the entering phase starts. Before POMI team actually opens the project number or enters the sales order, they collect information about customers and payment terms and define the VAT codes. Sometimes this information collection is executed already in the document checking phase and sometimes when the project number is opened or sales order entered. According to the interviews, the order of the tasks varies. An interviewee told that *"It is difficult to determine the order for the different tasks. Probably we all* [order management coordinators] *collect the necessary information and check the documents in different ways, because the process is not standardized. In addition, I can make the steps in different order depending on the day and mood."* Therefore, it is challenging to draw a process graph of the process.

One step is to check the customer data by enriching the customer basic data to ERP and possibly proposing new customers to customer master data. In Valmet Automation, customer master data is located in both ERP system and customer relationship management (CRM) system. Another task is to determine the correct VAT code for the sales case. In order to define the VAT code, order processor must check, for instance, executive supply center and customer details. The supply center or sometimes several supply centers should be determined in the documents, but often there are errors or the information is missing. Then order processors have to ask it in order to determine the right VAT code. In addition, POMI team checks the payment terms from the order or contract. If it includes an advance payment, the process proceeds directly to the project number opening. If a letter of credit without an advance payment is required POMI team creates pro forma

invoice for the customer, who needs it to open the letter of credit. In this case, pro forma invoice is a like a copy of an invoice, however, it requires no payment of other actions from the customer.

In order to open the project number, order processor must define the right serial from the product category and open the project for the next free number. In addition to the product category, POMI has to know if the sales case is capital or service and is it actually a project at all. Smaller projects that are more like product sales, are managed almost identically, however the project number is different. There are a lot of instructions how to determine the order type and project number. The interviewee also stated that it is a critical phase in the process: *"Order management in our team is always quite similar. However, the biggest issue is to determine what kind of case a certain project is. In addition, one challenge is that the units do not follow the given instructions and the project order might be incorrectly used with smaller orders."*

In addition, the product-group-based activities are added to the project number. Sometimes the activity structure changes during the project and POMI team has to update it based on the project managers instructions. After the project number is opened, a sales order for project can be opened. The sales order includes product group specific order rows. One main project can include as many sales orders as necessary. It is typical that the project includes one main sales order and one or more add-on-orders that are added later to the project. If the project is a pass-through project, an internal purchase order (IPO) is required from the AUT unit or purchase order (PO) from Valmet Technologies. One of the order processors determined IPO as following: "*IPO is like a copy of the order or contract that is between AUT sales unit and end customer, but internal between VA Finland and the other AUT unit. Therefore, IPO must be, for instance, in the same currency as the order or contract with the end customer."* In addition, IPO has to be delivered before the sales order is entered (order rows and activities are added) into the ERP system.

After the project number is opened and sales order(s) entered, order processor must inform at least project manager, financial controller and sales manager about the new numbers. Then the sales manager sends a sales confirmation to the customer, project manager starts to execute the project with other functions and controller opens the same project number to other systems in order to control the project finance.

POMI team is also responsible for applying the bank or corporate guarantee if it is needed for the project and the contract is between end customer and Valmet Automation Oy. They create the applications and confirm that all applications are issued. The most applied guarantee types for POMI team are advance payment guarantee and warranty guarantee. Sometimes it is challenging to apply the guarantee with incorrect information. According to the order processor, "*It is problematic that some of the sales managers do not use Valmet's "standard guarantee terms". Other terms might include some unsuitable aspects that require extra work from us.*" Usually the guarantee is applied after the advance

invoice is sent. However, especially some Asian countries cannot be invoiced before the guarantee is issued. In any case, the project manager has to be informed after the guarantee is issued.

Generally, a project requires several (for instance two to eight) payment installments during the process. The values are either fixed or percental prices that are negotiated in the contract. POMI team creates all the payment installments already in the order entering phase straight after the sales order is opened, even though some invoices are sent months or years later. They define it is the best way to work, because it is easy to notice and remember all the special requirements for the invoicing while they are checking the documents for the project order entering. In other words, some of the information, for example from payment and delivery terms, might be important also to the invoicing phase. One order management coordinator explained it as follows: *"It is easier to make no mistakes with the invoices if all the necessary information is added to the info boxes of installments already in the order entering phase. Otherwise it would be really slow to go over the documents again and again always when the next installment has to be invoiced. Therefore, it is important to go through the documents very carefully and write notes about the special requirements."* Special requirements for the invoice are, for instance, letter of credit, guarantee or take over certificate that are agreed aleady in the contract.

In the invoicing phase, POMI team creates, books and sends the invoices. The first payment installment is always invoiced with an advance invoice, that can be sent to the customer directly after the sales order is created and before the project execution starts. However, with Asian countries the guarantee is usually required to be issued before the first invoice. The other installments are invoiced after the project manager marks a payment installment as 'ready for invoicing'. The installments are usually ready for invoicing if the project achieves a certain agreed milestone. Typically, order processor generates the invoice proposal from the inserted data in the ERP system and then checks and modifies it, if needed. In addition, POMI team checks the info box and confirms that all the needed documents for the invoice are available. When the order processor accepts the invoice, it turns to the 'booked' status and the information transfers to the accounting. Then the invoice is sent to the customer with e-invoice, e-mail or manually printed with a signature. Some of the AUT units that use the same ERP system, can be invoiced also with Lean-to-Lean invoices. After the invoicing in completed, the payment installment's status updates automatically to 'invoiced'.

When the whole project, including final invoice, is invoiced, the status of the project changes to 'invoiced'. Then the project manager creates a project closing form that triggers several financial activities among the financial controllers. For instance, the financial controller checks if the project is a pass-through that needs a calculated commission. Controller calculates it and informs POMI team who creates and sends the commission invoice to the AUT unit. With the commission invoice AUT unit receives some income for the sales contribution they did in the pass-through case. After that the project is closed.

However, its status is ‘post-active’ that enables the financial activities also after the project. The last step of the process is closing the project number in the ERP and other systems by the financial controller.

4.4 Order management and invoicing of the service and product sales

In a project-based firm, the projects are the main business type in the focus. Therefore, also this thesis focuses most on the projects introduced in previous subchapters. However, in Valmet Automation, service business is told to be as important as the capital business (in this case projects). Therefore, also the service and product sales order types are introduced in this subchapter. Product sales can be divided into three order types (end customer sales, internal sales and trials) as introduced already in the Table 3. However, this study combines external and internal product sales. Service sales, on the other hand, are divided into four main business types that are also discussed as order types in this thesis. Service sales includes spare and repair sales, demand service sales, service agreements and trainings.

In Valmet Automation, **product sales** refer to the capital sales that are smaller than a project and conducted in Kajaani supply center. In other words, product sales business includes stand-alone analyzer deliveries smaller than EUR 100 000 and all separately sold measurement orders regardless of the contract sales price. Previously Kajaani product sales was called day-to-day sales. Order management and invoicing of product sales in Kajaani differs from other order types, because the order processors manage the orders during the whole delivery process, from order entry to delivery. Order processors in Kajaani supply center are called Kajaani logistics coordinators. Order entry of the product sales is special, because the products usually require configuration, that is not done for other order types. Product sales are usually invoiced with one installment after the delivery. In addition, product sales include always hardware and software, but only sometimes a little labor. Some procedures for product sales are currently (in the end of this thesis writing project) introduced also in Tampere supply center. However, they are excluded from the scope of this study.

Trial is typically a pre-made test run equipment that is sold and installed for the end customer for a trial use in order to convince the customer and replace competitor’s automation systems. The end customer value of a trial is less than EUR 100 000, so the order is product sales, even though it is opened for a standing small project number. In Valmet Automation, trial is the order type that most closely resemble a make-to-order production, because trials are finished products which are not in effect customized. The orders usually include labor and hardware, but only seldom software, because that would require more customization. Some of the orders might come through the AUT unit, however, the end customer order should always be booked directly to Finland.

In addition, the invoicing is quite special with the trials. If the customer is happy with the trial and makes an order for the actual automation system, the trial costs will be compensated for the customer in the new customer order. If the customer is not convinced by the trail, it does not bind to anything and the products are just fetched back to Valmet Automation. According to the interviewee, there might be some differences how to handle a trial case depending on the product group. Trials in some product groups include premade test run equipment that are not automated (do not include software) and can be used only in the trials. However, some trials can be conducted with actual products, that do not have to be replaced, if the customer wants to make an actual order. Therefore, the order might include also software.

Service sales is basically the next step after the project is executed. It usually relates to some existing installation base, that requires maintenance or improvements, for instance, spare parts and software updates. However, in Valmet Automation, the customer can buy also the services without any previous projects or installation. Typically, the service orders, except service agreements, are entered by the supply chain or service function itself and the invoicing is conducted after the delivery by POMI team or shipping department. All the service sales are entered to a certain site ID, that is a site/area/country-based number, used for follow up purposes. For instance, invoicing and cost transactions are directed to activity codes under each site ID.

Service agreement is an order type that involves a pre-agreed contract with the local service office and end customer. Typically, the contract involves certain services, such as on-call service, maintenance workdays and maybe some spare parts, for certain time and costs. Order is service agreement, if the contract is made at least for a year it is invoiced periodically, typically once every month or quarter. In Valmet Automation, the invoicing is semi-automatic, because the ERP system creates the invoices automatically to the invoice list. However, the service assistant has to go through the installment invoices every month and approve them. E-invoices are sent automatically, but some of them have to be printed out from the system and sent as paper copy or e-mail.

The process should be automatic, however according to the interview, some agreements still require a lot of manual work, like the service assistant told: *"If the customer wants to have only one row in the invoice, I have to make a new payment installment every month manually. And if the invoicing period is something else than a month, I have to change the dates to the invoices. Some major customers might also have other requirements that are not possible to automate in the system. Therefore, I have a lot of notes about different exception.s It would be really nice to have info boxes for the invoices too."* In addition, the interviewee pointed out that the closing dates of the agreements are not marked in the system. Therefore, there has been some challenges with the invoicing. Some contracts have been extended but no one has updated the information to the system and then some invoices have not been sent. *"I hope that the system could inform that if the invoice is the last installment of a contract."*

Spare and repair sales involve all the products and components that are sold for spare parts for various customers. In addition, it includes repairing of previously sold quite expensive components and spares like IQ sensors. Both the spare parts and repair sales involve only hardware. Order management, especially order entry, of spare parts can sometimes be quite complex process, because the customer orders might come in various ways. Sometimes the order processor receives only a broken part or a picture of the old part and no other information about the actual spare part. Then the order processor has to act as a "detective" to figure out what the customer actually wants to order.

Demand service sales, on the other hand, can include basically everything from labor to hardware and software, but always at least some labor. One interviewee summarized it well: *"Demand service is anything from four hours maintenance work for almost EUR 100 000 project-like order with some hardware. However, demand service is not a project, because the job is usually conducted by one or only few employees, and it does not require project manager.*" Typically, all the customers are from Finland, because the other service units would serve the other customers locally. Some of the demand service is easy to invoice with the fixed price. However, some orders are invoiced based on the costs, e.g. working hours and travel expenses, that complicates the invoicing process. According Valmet Automation's definition, demand service includes also training that is introduced as separated order type below.

Trainings refer to the courses that include instructions and exercises about Valmet Automation's products. Even though the attendees might actually use the products, the order type is defined to include only labor. Some of the trainings are general courses and the others are customized for customer needs. In addition to the internal employees, training can be held for end customers, other AUT units, Valmet Technologies and VAR partners. Invoicing occurs generally after the course is finished based on the confirmed count of attendees. Service assistant creates the invoice directly from the entered order, however, POMI team checks, books and sends it.

These different service and product sales order types can be compared to each other. The trials are included in product sales in order to simplify the tables. These two order types are quite similar in every other aspect except where the order is managed and invoiced. In this thesis, Kajaani handles the actual product sales (old day-to-day) and Tampere handles the trials. Otherwise the processes and tables would be quite complex because both the supply centers still have its own way of working with the product sales. Details about the order management and invoicing processes of the service and product sales are introduced in the following tables. KLC in the tables refers to Kajaani logistics coordinator. EPO is an electronical purchase order and eIPO is an electronic internal purchase order. In the first table, some of the order contents are marked in brackets, when it is not so typical content for a certain order type. Table 6 includes order entry details and Table 7 the invoicing details.

Table 6. *Order entry details about service and product sales*

Order type	Order content	Order entry method	Order entry responsible Tampere	Kajaani
PRODUCT SALES*	HW (+ SW + Labor)	Manual, eIPO, L2L	POMI	KLC
SPARE AND REPAIR	HW	Manual, eIPO, L2L	Spare part coordinators	KLC / Customer service coordinator
DEMAND SERVICE	Labor + HW + SW	Manual, EPO, eIPO, L2L	Service / supply chain	KLC / Customer service coordinator
SERVICE AGREEMENTS	Labor (+ HW + SW)	Manual	Service assistant	Customer service co-ordinator
TRAININGS	Labor	Manual	Service assistant	-

eIPO = electronic internal purchase order, EPO = external purchase order,
L2L= Lean-to-Lean, KLC = Kajaani logistics coordinator
* = Tampere trials, Kajaani actual product sales

Table 7. *Invoicing details about service and product sales*

Order type	Invoicing installments	Invoicing responsible Tampere	Kajaani
PRODUCT SALES*	Seldom	POMI	KLC
SPARE AND REPAIR	No	Shipping department	KLC / Customer service coordinator
DEMAND SERVICE	Maybe	POMI / supply chain	KLC / Customer service coordinator
SERVICE AGREEMENTS	Yes, automated	Service assistant	Customer service coordinator
TRAININGS	No	POMI	-

KLC = Kajaani logistics coordinator, * = Tampere trials, Kajaani actual product sales

Some details that are included in the main summary table are left out from these tables in order to simplify them. For instance, all the order types, except service agreements, include both external and internal customers. Typically, the internal customer is another AUT unit that sends Valmet Automation Oy an internal purchase order that is mandatory for the order entry phase. In these cases, the end customer order is booked in the AUT unit as a copy in VA Finland with the IPO. Another example of information that is left out from the tables are different prices that are used in the invoicing: end customer prices with external customers and transfer prices with internal customers. Third example is identification ID that for projects is project number, but in service the orders are identified with site IDs and in product sales with standing numbers. Both standing numbers and site IDs do not require opening from the order processor, unlike project numbers does. In

addition, order specific activity codes are used in product sales, demand service and service agreements for identification.

4.5 Challenges in order management and invoicing

This chapter completes the current state analysis by providing a list of the challenges that the organization faces in its current order management and invoicing processes. All the challenges that came up in the data are introduced in this chapter. They are categorized into three, based on how widely they affect to the processes. Some of the challenges, for instance global supply chain and various order types, are not necessarily challenges themselves, but more like features of a global business. However, these features should be handled better, in order to manage and invoice the orders effectively and efficiently. Therefore, they are also marked as challenges that are listed in the following Figure 16.

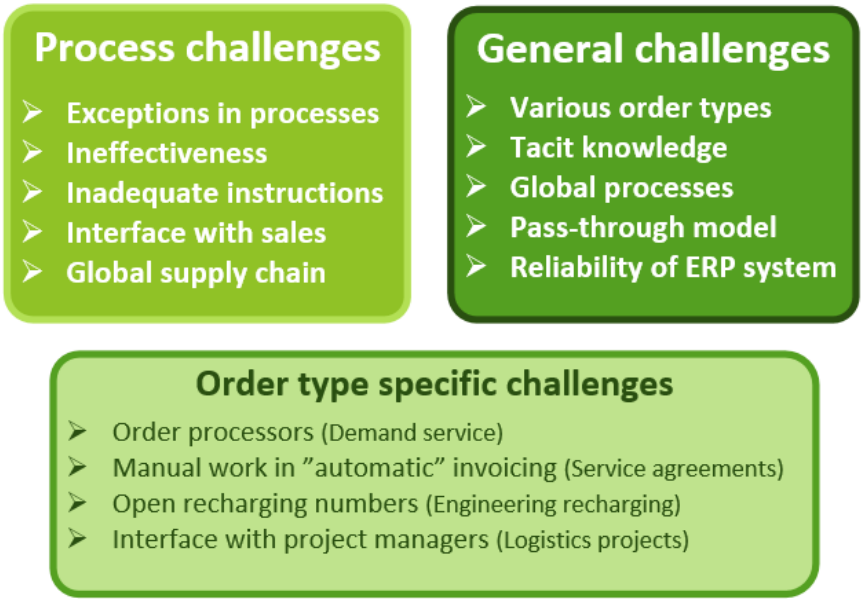

Figure 16. *Challenges in current order management and invoicing processes in Valmet Automation Oy*

In the Figure 16, process challenges and general challenges are listed first, because they occur in wider scope than the order type specific challenges. *Process challenges* are difficulties that relate to all or almost all the order management and invoicing processes. These were all discussed several times with different order processors and during the observation. *General challenges,* on the other hand, do not occur in the order management and invoicing processes but relate closely to the topic. These challenges affect to most of the order types equally. In addition, general challenges typically relate also to other functions and processes in Valmet Automation Oy. The third category is the order type specific challenges that are like specific examples of the process challenges. Some other order type specific difficulties came also up from the data, but they were so minor, that they are only included in the explanations of the process challenges. All the challenges are introduced in following subchapters.

4.5.1 Process challenges

Exceptions in processes refers to the challenge *how to handle the order management and invoicing effectively and efficiently with countries that have different requirements.* It is one of the process challenges in current order management and invoicing processes. According to the interviews, certain countries, like Brazil, India, Poland and Russia cause a lot of exceptions for order entry and invoicing with, for instance, special taxation. In addition, supply centers in different countries in factory-factory projects cause a need for several order management and invoicing processes with exceptions. On the other hand, these countries are important business areas in a global company, so they cannot just be removed from the areas.

All the exceptions, do not necessarily relate to the special countries. For instance, some main projects are special if they need an advance project number opening, include two supply centers or include incorrect information in the sales card. In addition, unlike in other projects, Asian countries cannot be invoiced before the guarantee is issued. The exceptions require a lot of tacit knowledge and excellent memory from the order processors, because of the lack of the instructions or automatic reminders inside the ERP system. The members of POMI-team estimate that more than half of the main projects include something special in the process. One interviewee summarized the situation: *"We have a lot special and complex processes that require different instructions. Therefore, many order processors have to read the instructions while they are opening the order and making installments."* This results also the ineffectiveness to the processes.

Global supply chain is a process challenge, *how to change current ways of working to match the needs of a global supply chain.* Still few years ago Valmet Automation Oy operated as a company that only exported ready projects to abroad. Like the exceptions, global supply chain is also a crucial and natural feature in a global business. However, Valmet Automation's business plan has changed and the delivery processes are nowadays global. According to the observation, some of the working methods are still not updated to match the needs for a global delivery process. For instance, one interviewee claimed that the supply center in Poland causes more harm than good for current processes, because the instructions are not clear and people are working differently in different units.

Ineffectiveness as a challenge refers to the *extra work, effort and time in the order entry or invoicing phases*. For instance, ineffectiveness in invoicing exists, for instance, as manual work and numerous options. In the main projects, some of the invoices have to be edited manually in the PDF editor and some of the logistics projects require different invoices for the delivery if it goes directly to the end customer instead of the AUT unit. In addition, demand service includes many different pricing lists for different customers. However, the pricing lists are not imported in the ERP and the information has to be checked form another database that includes all the service contracts. In addition, Brazil cases have so special pricing method that some of them has to be checked by a pricing

specialist. Manual work in service agreements' invoicing is also one example, but it is more closely discussed in Subchapter 4.5.3. Ineffectiveness in the order entry, on the other hand, arises from the inadequate instructions and the poor coordination with sales and other previous functions.

Interface with sales as a challenge is *the difficulty to receive all necessary and correct information for order entry*. For instance, according to the current state analysis, some sales managers deliver incomplete information for the order processes which requires extra work and time for the order entry. Sometimes the project number opening can delay just because a sales manager in another unit did not change the status of a sales card to 'won'. The time difference might also increase the delay. The challenge is quite significant especially in the POMI team with the main projects. In addition, the sales managers do not always use the standard payment and guarantee terms in all the sales cases. Then these mistakes have to be checked in the order entry phase which increases the ineffectiveness. In Kajaani, the logistics coordinators also struggle with the delivery times the sales managers have promised before checking with the production.

Inadequate instructions refer to the *instructions that are incomplete, complex, outdated or otherwise difficult to understand*. This challenge relates closely to the other process challenges, because most of the others are caused by the inadequate instructions or the challenges could be decreased by improving the instructions. As a matter of fact, the inadequate instructions could be included in the description of the other process challenges. However, it was separated as an own challenge, in order to highlight it. In this thesis, it is actually quite difficult to list and separate the process challenges, because they relate closely to each other. The following Figure 17 demonstrates the relations between the different process challenges within the order management and invoicing processes.

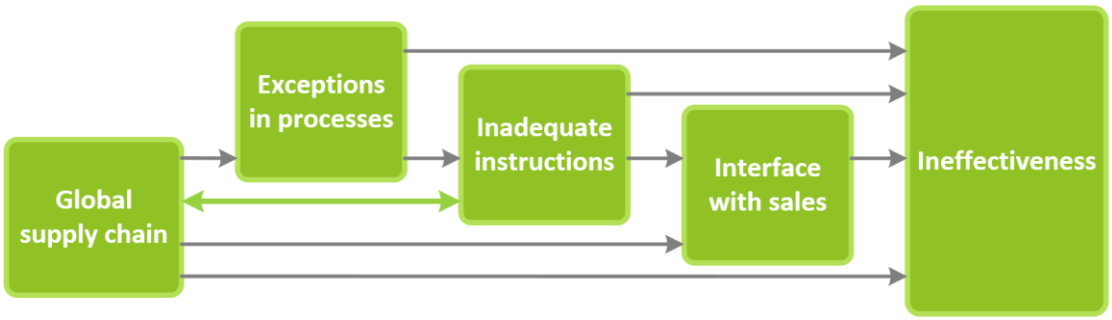

Figure 17. *Relations between the process challenges*

In the Figure 17, the relations are represented with the grey arrows that demonstrates which challenge increases the other. For instance, ineffectiveness is increased by all the other four process challenges that are connected to it with the arrow. The relation between global supply chain and inadequate instructions is highlighted with the green two-way arrow, because the direction of the correlation is not clear. The inadequate instructions cause difficulties with the global supply chain; however, global supply chain has also

caused flaws to the instructions. All in all, these challenges are like a vicious circle, because, for instance, exceptions cause inadequate and complicated instructions that in turn cause other challenges, like ineffectiveness in the processes. The process challenges are also quite wide topics that may include several subchallenges that differ from an order type to another. The subchallenges are introduced more closely in the Subchapter 4.5.3.

4.5.2 General challenges

Various order types are an example of general challenge that relate closely to order management and invoicing but are not included directly in the processes. Based on the analysis, the challenge is not the various order types themselves, but the too high number of them. Currently Valmet Automation Oy has 19 different order types, in other words, order management and invoicing processes. Actually, the order types could be divided even further into smaller pieces, if they would be discussed with the simpler processes. One interviewee phrased it well: *"We have too many order types. In a company, that has about EUR 300 million net sales a year, almost 20 order types are too much."* A figure of all the order types is introduced first time in this thesis, because the order management and invoicing has not been centralized or coordinated. It is divided into several functions/teams and almost every order type is handled separately. In addition, the order types are now categorized and comparable for the first time in the summary table, that is also created in this thesis.

Tacit knowledge that is stored within the employees, is another general challenge in Valmet Automation Oy. Based on the interviews and observation, only few persons understand the big picture of order management and invoicing in Valmet Automation Oy. Even though they do not know that much about the processes and working methods in the other supply centers and units, they have a lot of tacit knowledge about the processes in Finland. Both the knowledge and employees are important for the company. In addition, some smaller topics in the order management and invoicing, like pricing methods in Brazil, end customer project with assembly abroad and product sales from Russia are special cases managed by certain individual employees. This makes these employees very critical human resources. If they would leave the organization, a lot of special information would also be lost. Based on the observation, some employees were also concerned about young employees and their interests towards Valmet. They were thinking, that Valmet Automation should do more in order to gather the best talents to its staff.

Global processes are the third general challenge, because according to the data, many of the current processes are modelled as global processes, even though they cover only processes in Valmet Automation Oy in Finland. One interviewee stated that: *"We have a problem with the global processes, because most of the process graphs, like project delivery process, that we have in our internal database are not actually global. They are just "Tampere-processes" that we would like to implement also globally. However, it is*

not that simple as we think." Actually, some minor differences in "global processes" between two Finnish supply centers in Tampere and Kajaani were also discovered in the interviews. For instance, Kajaani does not use site IDs for all spare part orders, but Tampere supply center does. In order to harmonize the order management and invoicing in Valmet Automation globally, the instructions and examples of standard processes has to be made. However, the process graphs provided in the current state analysis in this thesis cannot be globalized as they are, before the differences are understood.

Pass-through model was also identified as general challenge in the order management and invoicing, because it increases the work of an order processor that might lack of understanding and motivation about the topic. One interviewee complained that: *"I do not see any sense in this pass-through model. End customer invoicing occurs in the AUT unit, why do we have to do the invoicing also with the unit and enter the order in our systems too. All the pass-through projects are entered and invoiced twice in this model."* However, in the big picture the model simplifies the work in the project logistics and project management as well as improves the quality of Valmet Automation's financial data. In addition, the unwanted surprises from the AUT units have decreased, because the projects are better controlled in Finland. Therefore, the challenge is how to better communicate the benefits of the model to the employees.

Reliability of ERP system relates to the challenge, that almost all the data is inserted by humans. Therefore, it might include some mistakes or something might be missing. For instance, some mistakes with the invoices, like with various invoicing addresses or VAT codes are noticed just after the invoice is created or already sent to the customer. During the observation, some mistakes were also noticed with the order types and other information filled to the customer order in ERP system. According to the interviewee, the flaws in the data are usually explained by the different working methods of various functions and order processors. *"The order types might be wrong, because spare part coordinators always fill up spare part order and logistics coordinators logistics order, even though sometimes the case should actually be some other order type."* In addition to the human mistakes, there has been some minor problems with the status updates, because the ERP system have sometimes failed in the batch run or otherwise crashed. If the system would always work perfectly and all the data would be correct, more steps in the processes could be automatized in the future.

4.5.3 Order type specific challenges

According to the analysis, there are also some challenges that relate only to an order management and invoicing process of a certain order type. **In demand service, service manager acts as an order processor**, even though the manager have also a lot of other tasks, like subordinates and customer relationships to manage. During the last 20 years, the service manager has always entered the orders, because he has to determine the external

responsible that takes care of the case execution. However, the business has tripled during that time and the order entry task requires quite a lot of work nowadays.

In service agreements, the automatic invoicing includes manual work, which is challenging. It is normal that the invoicing includes some manual work, however, service agreements should be automatically invoiced. Currently the order processor has to check all the invoices every month and approve them before they are sent to the customer. In addition, the order processor has to check if the invoice includes some exceptions and manually make the changes. The exceptions are listed in a "sticky note pile" that the order processor has to go through manually every month. Therefore, this challenge is like a subchallenge within the process challenge ineffectiveness, because automatic periodic invoicing could be managed more efficiently.

Tracking of **the open recharging numbers in engineering recharging projects** is also a subchallenge of ineffectiveness. It refers to the situation, where the order processor tracks open engineering recharging numbers in an excel that has to be manually updated, in order to know what numbers are open and what to invoice. It is quite ineffective and risky to use separated and manually filled excels in order management and invoicing, because employees make errors. Interviewee also stated that, *"People are not really interested in the recharging numbers. Project managers just track the main project numbers and forget the recharging numbers."* The manual excel list includes also some other important information for the invoicing like contact persons, index numbers and necessary attachments. In engineering recharging projects, excel is also used to make the attachments, like cost separation, to the purchase orders.

Interface with project managers in logistics projects is causing difficulties in order management and invoicing. The main challenge is with the information the supply chain receives from the project managers. One of the interviewee phrased it well: *"Our work would be much nicer and more profitable in the project delivery, if the project managers would tell us already in the order entry phase if the case is with a letter of credit or penalty. Currently the information appears after the project is already late. The losses would have been avoided, if we would have known earlier."* In other words, the order processors face challenges with the lack of information in order entry phase with both internal logistics projects and the main projects. This is like a subchallenge to the interface with sales, if the sales and project managers are just discussed as a previous function.

4.6 Improvement ideas for challenges in order management and invoicing

In order to rise to the challenges, proposals for improvements are presented in this chapter. Most of the improvement ideas came up during the observation and the interviews or

while analyzing the data. The improvements are created based on the challenges introduced in previous Chapter 4.5. Therefore, every challenge has at least one improvement idea. The proposals for improvements are presented in the Table 8.

Table 8. *Improvement ideas for challenges*

	Challenge	Improvement ideas
Process challenges	Exceptions in processes	New or updated instructions + training Report (about the exceptions) Standardized processes Tacit knowledge to the systems
	Ineffectiveness	Improved coordination and cooperation Improved ERP system (less manual work) Tacit knowledge to the systems New instructions + training
	Inadequate instructions	New or updated instructions Standardized processes
	Interface with sales	Improved coordination and cooperation Information management New instructions + training Better working methods
	Global supply chain	New or updated instructions + training Report (about global requirements)
General challenges	Various order types	Re-categorization of the orders Centralized order management and invoicing Standardized processes
	Tacit knowledge	Information management Tacit knowledge to the systems Committing employees
	Global processes	New instructions + training Report (about local differences) Standardized processes
	Pass-through model	Education about the pass-through model Updated instructions + training
	Reliability of ERP system	Improved ERP system New instructions + training Information management
Order type specific challenges	Order processors	Re-organizing human resources
	Manual work in “automatic” invoicing	Improved ERP system
	Open project numbers	Improved ERP system
	Interface with project managers	Improved coordination and cooperation Updated instructions + training

The Table 8 includes all the improvement ideas that rise from the data analysis. Altogether there are 13 different improvement ideas, one to four per a challenge. New instructions

and training appear most (nine times) in table, when the second most proposed improvements are improved ERP system and standardized processes in four different challenges. The other, probably more specific ideas appear less, because some of the challenges are also quite specific. However, some of the ideas could be merged together for bigger and more significant improvements. For instance, committing employees, education about the model and re-organizing human resources are all tasks of human resource management. After the merging, there are six improvement proposals for Valmet Automation Oy, that are listed in the Table 9.

Table 9. *Merged improvement proposals for challenges*

Original improvement ideas	Merged improvement proposals
New or updated instructions + training Report (about something)	**New or updated instructions + training**
Improved coordination and cooperation Better working methods	**Improved coordination and cooperation**
Improved ERP system	**Improved ERP system**
Tacit knowledge to the systems Information management	**Improved information management**
Standardized processes Re-categorization of the orders Centralized order management and invoicing	**Process changes**
Committing employees Education about the pass-through model Re-organizing human resources	**Improved human resource management**

The merged improvements for the challenges are 1) new or updated instructions + training, 2) improved coordination and cooperation, 3) improved ERP system, 4) improved information management, 5) process changes and 6) improved human resource management. Most of the proposals are quite wide and abstract, for instance improved ERP system or improved information management, because they do not specify the change or a certain objective. On the other hand, the improvement list would be too long, if the ideas and proposals would be described in detail. Therefore, the improvement proposals are defined and their impacts are explained in the following paragraphs.

New or updated instructions + training are combined as one improvement proposal in order to ensure that the instructions are actually understood and the new methods are implemented, not just written in the paper. With new or updated instructions, the company may ease the work with the exceptions in the processes and simplify or complete their otherwise inadequate instructions. Based on the analysis, many of the exceptions in processes relate to special regulation of a certain country. It is not easy to simplify these special taxation or custom issues. However, with well-structured and clear instructions

the same work can be done much faster, especially when the order processors always complete the hard cases while reading the instructions at the same time. Therefore, the instructions have an impact also to ineffectiveness of order entry and invoicing. The instructions are actually a great solution for most of the challenges, that relate to complexity or changed situation, as it is marked in the Table 8. This improvement proposals includes also reports about current state, such as the exceptions in processes, local differences and global requirements. These are the topics that the company has to look into before the improvements and new or updated instructions can be actually made. These reports can be conducted, for instance, with internal analysis or other master thesis.

Improved coordination and cooperation refers to the interface between order entry and the previous function. It is a solution for especially POMI team's challenge, the incomplete information from sales managers. This improvement includes also the better working methods, for instance, using information systems and automatization instead of e-mails. E-mails should not be used as systematic information transferring tool between the functions, because e-mails might be missing information, like attachments, include mistakes or a lot of unnecessary information (long message history with irrelevant people), which all decrease the effectiveness. Coordination could and should be improved also with other functions and teams. According to the observation, employees prefer to work with people they know. One order processors stated that *"It is always nicer to discuss and work with someone, even with e-mails, if you have actually seen the other person."* Therefore, the functions should organize workshops, training days, meetings, discussions, coffee breaks and other gatherings with the employees from different functions.

Improved ERP system as an improvement would add few features, for instance alarms for exceptions, to the already well-working and flexible ERP system. These features, that are not currently available, would ease order processor's work and streamline the process. Exceptions refers to the specialties that order processors currently have to manually check or just remember, for instance, different invoicing methods. Alarms, on the other hand, would be notifications the system makes automatically about the specialties during the process. In addition, all order types should have "line-based" info boxes for sales orders, and payment installments for order processors to write notes into the system. The system could also contain all the price lists and information about order status, to make the invoicing more effective and solve the challenge with open engineering recharging numbers. The automation in the system would decrease the manual work in invoicing and increase the reliability of the ERP system. However, the reliability of the ERP depends most on the quality and validity of the data employees place to the system. Therefore, information management is also very important improvement for ERP reliability.

Improved information management means the collection and transfer of information within the company. The improvement includes also the idea of collecting the tacit knowledge into the information systems. Information management creates a standardized

way to identify, collect, transfer and store information within an organization. It is a significant factor in keeping record about all tacit knowledge and other information that is hidden inside the employees with certain methods and processes. It is also a precaution for sudden changes in the personnel. Information management secures also a smooth information flow between the functions and information systems, like form sales cards to ERP, and streamlines the whole order management and invoicing process. In addition, the logistics projects will be better managed by the supply chain and order processors, if the project managers tell all the necessary information about certain case, like penalties and letter of credits, to the order entry phase. Information management in also in charge of storing the information so that is understandable and available for the employees.

Process changes as a solution includes re-categorization of the orders, standardized processes and centralized order management and invoicing because they all relate to each other. Standardized processes would streamline the order management and invoicing process and enable the global harmonization. It would also ease the order processors' work, because the instructions would be simpler. The countries that cause some of the exceptions in processes cannot be removed from the organization's scope, but the special business environment requirements can be better managed. Standardization relates closely to the re-categorization of the order types that has also indirect impacts on the ineffectiveness within the process. For instance, only 4-7 processes instead of the current 10 could streamline the situation a lot. Of course, it might be challenging to squeeze the differences and exceptions to the same processes and different order types into only few. Therefore, the whole order management and invoicing should be centralized for certain educated and professional order processors, that would cover all the order types globally. In the future, the current OMI function could be global function with senior manager that manages the processes globally.

Improved human resource management refers to re-allocation and re-organization of the human resources, educating and training of the employees, leadership and management skills and information sharing. Therefore, some order processors could be re-located into more suitable tasks, like in demand service process and also the effectiveness of the process could increase by employing the right people. It has also a major impact on collecting and protecting the tacit knowledge and providing understanding and motivation for employees about different working methods, like pass-through model, that for some order processors have felt like unnecessary work. With improved human resource management, employees' commitment towards the company can be also increased, which in turn secures that the tacit knowledge stays in the organization. The centralized order management and invoicing, that is listed as one of the process changes, can also be seen as improved human resource management. If all the tasks are centralized to the certain order processors, all different order types would be better managed. This would require new order processors roles and organization changes, because currently a lot order processors' tasks are executed in other functions and teams around the organization.

5. DISCUSSION OF RESULTS

This chapter concludes the main characteristics, challenges and improvements of order management and invoicing processes by discussing about the results of literature review and current state analysis. According to the thesis, a project-based firm includes various order types and processes for every order type. Based on the discussion, order entry is the most important phase of the order management and invoicing process. The main challenges a global project-based firm faces in order management and invoicing, relate to the complexity and variety of different global orders. Organization can handle the challenges with new or updated instructions and training, process changes and improved ERP system. How Valmet Automation, could tackle these issues is introduced more closely in the roadmap of improvements.

5.1 Main characteristics of order management and invoicing processes in a project-based firm

Based on the current state analysis, a project-based firm includes many various order types, from projects to products and service sales. Literature has defined a project-based firm as a company that does most of its work in projects (e.g. Lindkvist 2004; Hobday 2000). Artto et al (2015, p. 71) have extended the definition by arguing that PBFs are normally providing also services for their customers after the project delivery phase in order to integrate more closely to customer's operations. This study recognizes 19 different order types in the target company. Eight of them are project order types and eight service order types. The remaining three are product sales that are kind of small projects, but without project manager, schedule or budget estimation and usually they are invoiced after the delivery.

The analysis suggests that almost every order type requires an own order management and invoicing process. In Valmet Automation, these processes of all 19 order types can be demonstrated with 10 different detailed process graphs. However, the process graphs include a lot exceptions, because many different processes are demonstrated within a same graph. For instance, all product sales are demonstrated within the same process graph, even though the trials differ from the actual product sales. Therefore, the current order management and invoicing processes in Valmet Automation are quite complex. Literature has not recognized a need to have an own order management and invoicing process for every order type, because it merges all order types into the same process. Therefore, the order management of projects or any other specific order type is not discussed. Invoicing, on the other hand, is categorized by the sales type and payment execution. Literature recognizes, for instance, that some orders are invoiced after delivery and some based on the agreements during the delivery. (Lahti & Salminen 2008, p. 80–83)

Currently every order management and invoicing process in Valmet Automation Oy includes four main phases: receiving, order entry, invoicing and closing. According the analysis, the tasks within the phases vary depending on the order type. This is because the order types have different content from hardware, software and labor to entire automation systems and they require various invoicing from advance payment and installments to periodic or recharging invoicing. The differences are collected to the summary table, that enables the comparison between the order types. This kind of categorization of the processes and definitions for the terms and phases in order management and invoicing process simplifies the both national and global order management and invoicing within Valmet Automation. Communication and coordination between the different countries, functions and teams is easier with common definitions. When people use the same (standardized) terms, everybody in the company knows what they are talking about. In addition, harmonization is easier with general process that provides a certain standard.

In the literature, order management and invoicing is not recognized as an own process or a concept. It is included in the other processes, like order fulfillment process that is an end-to-end supply chain management process from first supplier to end customer (Croxton 2003). Therefore, the OMI processes are described much more detailed in this thesis than they are usually discussed in the literature. For instance, most of the activities (generate order, transmit order, receive order, enter order and edit order) in Croxton's (2003) model of order fulfillment process are defined as main phases in the general order management and invoicing process in VA Finland. Both order management and invoicing processes are introduced in the Figure 18 in order to compare them.

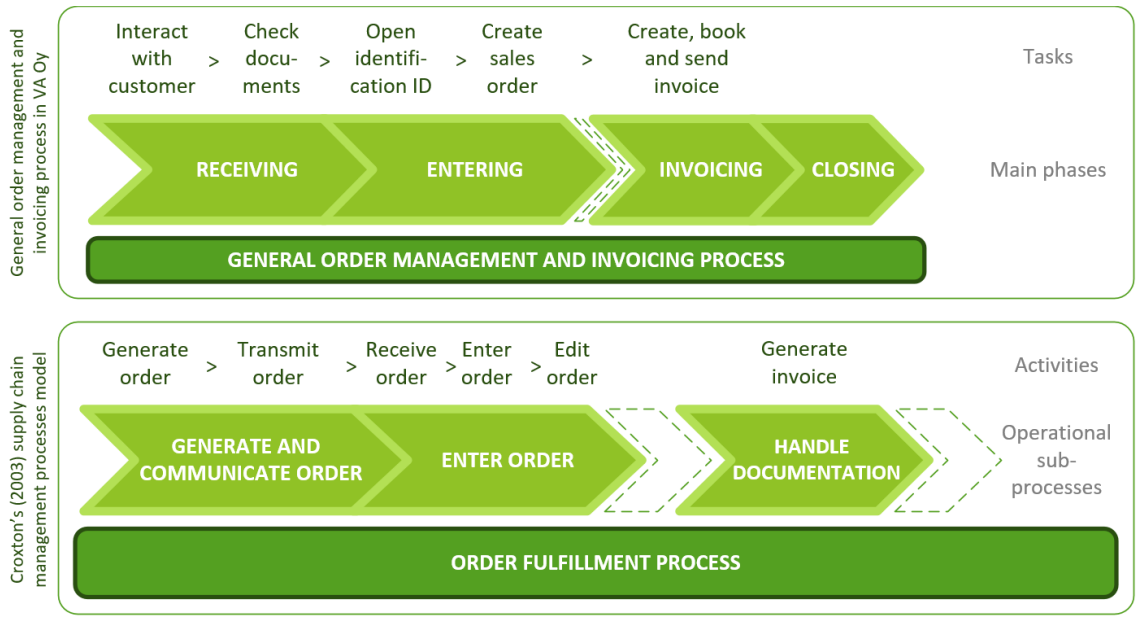

Figure 18. *Order management and invoicing process in Valmet Automation Oy versus in the literature*

In Figure 18, the general order management and invoicing process in Valmet Automation Oy that is introduced already in the Subchapter 4.1, is completed with general main tasks. The lower part of the figure, with Croxton's (2003) order fulfillment process is a simplified version of the Figure 5 in Subchapter 2.2.2. The length and size of the dark green bar demonstrates that order fulfillment process is an end-to-end process that includes various subprocesses. Order management and invoicing process, on the other hand, is only like an extended subprocess of its own that does not cover the whole supply chain. It is also shorter than order fulfillment process. The colorless process arrows within operational subprocesses illustrate the other subprocesses of the order fulfillment process that are not discussed in this thesis. In the general order management and invoicing process, all the main phases relate closely to the topic itself. The process is also linked to other functions and processes. For instance, order filling and order delivery are usually happening before or during the invoicing. Therefore, there is a small dash line arrow in that process too.

Only order entry is named in both processes, so it is the most important step in the order management and invoicing process. It is called 'entering' as a main phase and 'enter order' as an operational subprocess. Croxton's (2003) operational subprocess is wider concept than the main phases in the target company, because it includes also activity 'receive order' that is separated as an own main phase in the general process. Based on the interviews and observation, order entry is also the most critical phase of the order management and invoicing process in Valmet Automation Oy. Order entry phase creates the information to the ERP system that defines the what the customer has ordered and how the order should be fulfilled. According to Stadtler and Kilger (2008, p. 186), customers must determine the configuration options at the order entry in order to enable the generation of a bill of materials for products that are configured. In addition, order entry is referred almost as a synonym for order management, that is defined as "*filling up the customer orders into the information management systems"* in this thesis.

5.2 Ways to improve order management and invoicing processes in global project-based firm

In order to recognize the main improvements from the six improvement proposals introduced in the Subchapter 4.6, the challenges must be discussed and the most significant ones identified. The bigger the challenge is, the more it requires an improvement. Therefore, the improvement proposals that are linked to the main challenges are the main improvements. Based on the analysis, process challenges and general challenges are more important challenges than the order type specific challenges, because they affect all the processes. However, there are also differences between the importance of the challenges within the same category. Therefore, the main challenges are not decided just based on how widely they affect, but based on how critical they are in terms of bottlenecks, regulation, customer satisfaction and how often they were mentioned in interviews or during

the observation. The challenges are discussed only with their names, because they are introduced already in the Chapter 4.5.

5.2.1 Main challenges

Global supply chain, **exceptions in processes** and **inadequate instructions** are the most critical process challenges. First of all, they affect most of the other challenges, i.e. act as bottlenecks for improvements. Secondly, all of them relate to regulation, not just internal code of action, as well as customer satisfaction. Global supply chain is established to serve customers faster and closer. Exceptions are made to serve customers special needs, on the other hand, exceptions increase complexity (both instructions and methods) and affect to the order cycle time. Based on Christopher (2011, p. 125) customers typically value precise order cycle time, therefore, exceptions should not be made, because specialties with one order typically have impact on other orders too. Thirdly, these process challenges came up almost in every interview and often during the observation. Therefore, these three are the main process challenges, while interface with sales concerns mostly only main projects and ineffectiveness is like a result from these other challenges.

Other main challenges in current order management and invoicing in Valmet Automation Oy are general challenges: **various order types** and **global processes**. Both affect generally to most of the order types, other challenges and customer satisfaction. Customers are happy if the process is efficient and streamlined, because then it is cheaper and more reliable form them too. Various order types cause, for instance, the challenges global supply chain and exception in processes. Global processes, on the other hand, require also a lot of knowledge about local regulation in various countries in order to harmonize and globalize the processes. In addition to those too main challenges, **order processor in demand service** is the most critical of the order type specific challenges, because it is a good example of global supply chain challenge. Other order-specific challenges are quite specified problems, while this demonstrates how “historical” and familiar working methods are sunk in the processes, even though they should have changed a lot.

5.2.2 Main improvements

The improvements are connected to the challenges in various ways, because the six improvement proposals are chosen to have impact on many of the challenges. Therefore, it is difficult to represent and explain all the connections between them. Every improvement proposal includes 1-3 smaller improvement ideas or aspects that are covered with the one title, like introduced already in the Table 9. The solution is not always to get rid of the problem or challenge, but to control and understand it in order to reduce it or cope with it. For instance, global process is not a challenge itself, but rather a characteristic of a

global business. Therefore, the challenge is how to operate in a global business environment. The Figure 19 represents all the challenges and improvements with their main connections.

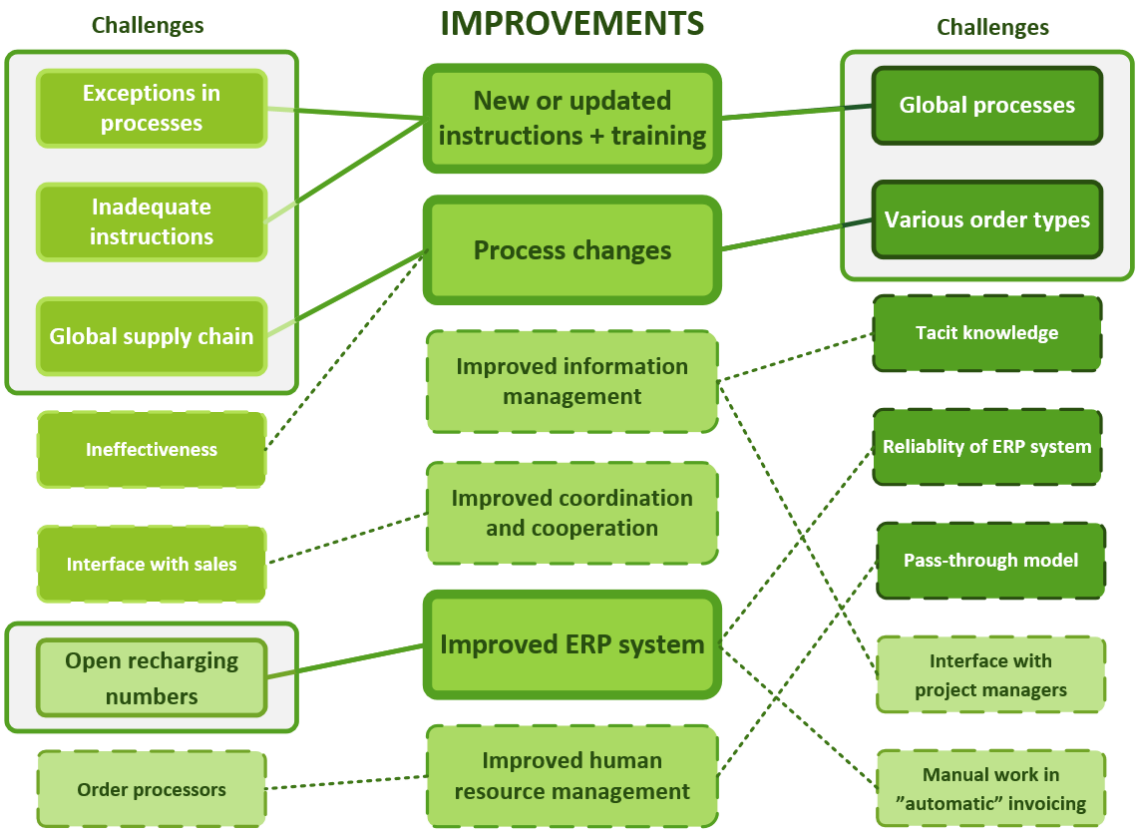

Figure 19. *Improvements for challenges in current order management and invoicing*

In the figure, every challenge is connected to one improvement that has the most influence in a certain challenge. Therefore, some of the improvements have more connections than the others. Challenges are color-coded like in the Figure 16. The bright green ones on left relate to all order management invoicing processes, the ones on right with dark green color are general challenges and the four light green ones on the bottom are order type specific challenges. The main challenges introduced earlier in this subchapter are highlighted with boxes.

Based on the analysis, the main improvements for global and harmonized order management and invoicing processes are **new or updated instructions + training, process changes** and **improved ERP system**. These can be recognized from the Figure 19, because these improvements are all the main solution for three different challenges and they cover all the connections to the main challenges. The other improvements are connected only to one or two challenges. Only improved ERP system and coordination between functions came up from both the data and literature review, while the others were discussed only in the interviews. The following Subchapter 5.2.3 discusses how Valmet Automation Oy should execute the improvements.

5.2.3 Roadmap for the target company

The main improvements of order management and invoicing processes should be executed in Valmet Automation as soon as possible and before the other improvements on the roadmap. It is quite difficult to define certain schedule or order for the improvements, because they relate closely to each other. Actually, it would be optimal to make some of the changes simultaneously. For instance, the instructions should match the situation after the process changes. Even though this thesis discusses about order management and invoicing processes, not all the changes relate to the process. For example, improved ERP system is a clear system change while improved human resource management is defined as an organization change. In order to execute the improvements, the main responsible functions or teams have to be named for the changes. The roadmap for handling the challenges and improving the order management and invoicing processes is introduced in the Figure 20.

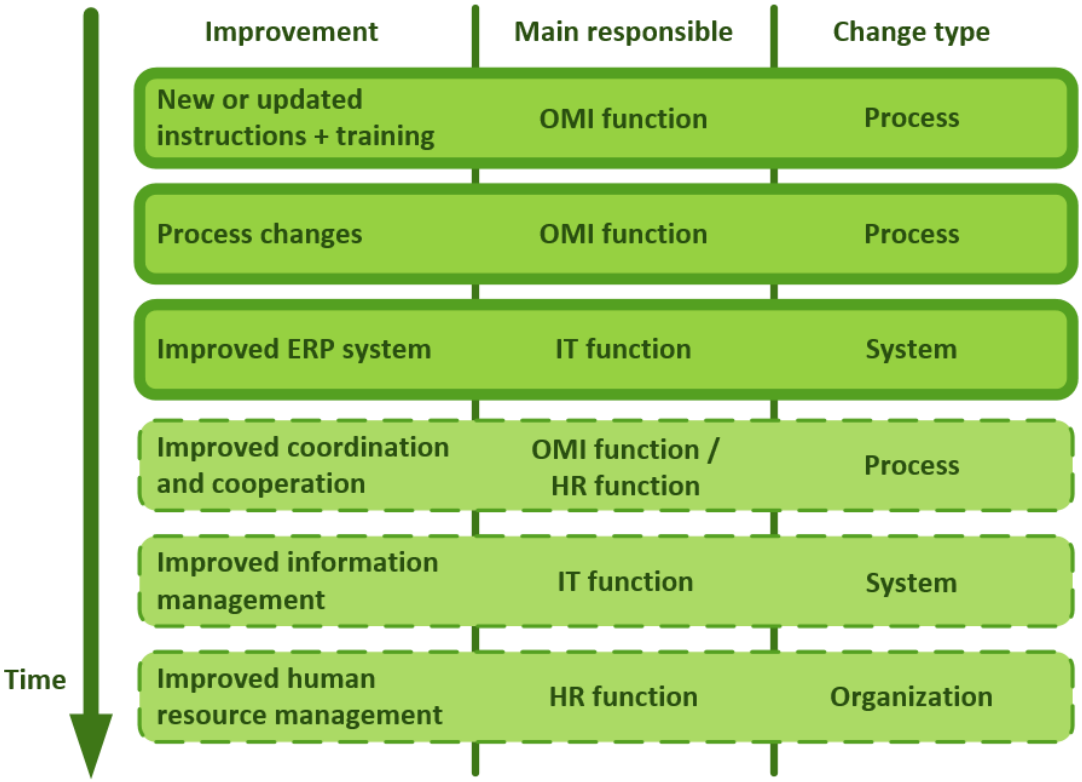

Figure 20. *Roadmap of improvements for Valmet Automation Oy*

Based on the current state analysis, **new or updated instructions + training** is probably the most significant improvement for the organization, because it has an impact basically to every challenge, even though only the main connections are highlighted in the Figure 19. Updated instructions provide a more efficient way to work with the exceptions in processes and enable the organization to harmonize the global processes. This improvement came up from many of the interviews. However, instructions were not discussed as

an improvement in the literature. In addition to the context of the instructions, the structure and naming of the instructions are important. They define how easy certain information is to find. In Valmet Automation Oy, OMI function should take care of updating the instructions and locating the missing information. The inadequate instructions can be located with the reports about the exceptions, global requirements or local differences that also enable the foundation to write the instructions.

The instructions and training relate closely to the **process changes** that include re-categorization of the orders, standardized processes and centralized order management and invoicing. These process changes can be implemented after the reports are conducted and instructions are updated based on them. The information about the reports can be utilized also in these process changes. For instance, the standardization or re-categorization is easier to after the current state is clear. Process changes affect also to the instructions, because they have to be rewritten after the changes have been conducted in order to ensure they are up-to-date. Therefore, process changes are also OMI function's responsibility. The process change centralized order management and invoicing relates also to the improved human resource management that is an organization change by the HR function. Therefore, the functions and team must coordinate their work to reach the common objective.

Improved ERP system is the third main improvement for the challenges in order management and invoicing in Valmet Automation Oy. Writers have pointed out that the ERP system should be installed to address specific needs and to fit in with organization's business characteristics (Gefen and Ragowsky 2005). Based on the analysis, improved ERP system in order management and invoicing would reduce the manual work and simplify the processes, because some steps could be automatized and exceptions included in the system. Therefore, order processors would not have to remember so many exceptions, because they would be automatically covered within the system. This same benefit is recognized in the literature, because ERP system provides a clear workflow for order processing with predefined activities that can be executed only in certain order (Derks & Weston 2005, p. 221). In addition, ERP system could reduce cycle times and enhance customer service (Gardiner et al. 2002). According to Su & Yang (2010, p. 84), the benefits of implemented ERP system can be categorized as operational, managerial, strategic, IT infrastructure and organizational benefits. These benefits will occur if the organization implements ERP system for the first time. However, Valmet Automation Oy has already a ERP system that many order processors find very good and flexible. Therefore, the organization has to pay attention how to renew the system in order to actually gain benefits.

According to the literature review, also **coordination with other functions**, especially with customers and sales is an important way to improve order management and invoicing processes. It is recognized to be the most critical improvement for the challenge 'interface with sales' in the Figure 19. According to Tehniälä & Ketokivi (2012, p. 176), a lot of

important details are specified already in the sales function with customers. If the coordination between various functions is poor, there might be some delays with projects which in turn increases the cycle time and reduce customer service level (Mello et al. 2015, p. 1006). Therefore, the order fulfillment process that includes order management and invoicing process should be led by a cross-functional team (Croxton 2003). This team would be better able to sort out problems and eliminate bottlenecks within the processes (Christopher 2011, p. 235). In Valmet Automation, the team would consist of people from sales office, project and service delivery, finance and order management and invoicing. Then order processors would work more closely with people from the functions that are connected to the order management and invoicing process. It would be OMI function's responsibility to take care of the coordination with sales, for instance, by increasing cooperation with workshops and creating a cross-functional team. In addition, HR function has a responsibility to improve the coordination between all the functions.

Valmet Automation should also improve information management and human resource management after the other previous improvements. **Information management** is mainly improved by collecting tacit knowledge and all other necessary information into the information systems. Therefore, all the data and information are accessible for all necessary employees globally. It would be IT functions responsibility to execute this system change. However, the top management of all the other functions should define what information should be imported to the systems and who should have access to it. **Improved human resource management** is HR function's responsibility to re-allocate and train the employees in order to increase the effectiveness of the order management and invoicing process. This organization change will affect also to employees' roles and processes in other functions, for instance, in sales and supply chain. In addition, it relates closely to the process change 'centralized order management and invoicing'. In the future, certain order processors could enter all the orders globally in Valmet Automation. Especially the main projects should be proceeded by trained persons, because the process includes a lot of exceptions. Therefore, the mistakes and delays could come expensive. After that also the other order types could have centralized order management and invoicing function and process.

6. CONCLUSIONS

Writing this master thesis was a very successful project. Valmet Automation Oy gave very practical objectives that were well covered both in the literature review and current state analysis. Based on the research, a project-based firm has different order management and invoicing processes, because of the requirements of different order types. Organization could improve its order management and invoicing processes mainly by executing process changes and by improving ERP system and coordination with functions. In addition, the company should provide updated instructions. The research was a single case study, that has naturally some limitations, however, the quality was improved, with multiple data sources and detailed description of the research process. The topic should be studied further, for instance, how to organize order management and invoicing function in a global project-based firm.

6.1 Main results meeting the objectives

In the beginning of the research process, the two main objectives were defined in the assignment by Valmet Automation Oy. First objective was *to create perceptive and deep understanding about the current order management and invoicing processes* with process flow demonstrations and extensive summary. Second objective was *to improve the order management and invoicing processes* in order to create a foundation to a globally harmonized and uniform processes. These two objectives were revised in order to create the research questions.

The first research question *"What kind of different order management and invoicing processes there are in a global project-based firm?"* was answered extensively with the current state analysis. According to the current state analysis, Valmet Automation Oy has 19 order types. These can be categorized to projects, service and product sales, like also in the literature. The literature does not recognize a need to discuss about different order management and invoicing processes, even though in practice different order types have distinct processes. For instance, in Valmet Automation all the processes can be described in detail in ten separate process graphs that were given to the target company. In addition, a general process, an example process of main projects and comparisons between the different order types were introduced in this thesis.

The current state analysis concluded that every order management and invoicing process in Valmet Automation Oy includes four main phases, receiving, entering invoicing and closing. Both literature and practice determine order entry to be the most important one. It is challenging to introduce one standardized order management and invoicing process,

because order types have special characteristics and requirements. However, identification of at least the main phases will ease the documentation and communication in Valmet Automation and in general. It is easier to streamline and harmonize the processes, when the main phases are defined. In addition, it enables the comparison between different functions, teams and countries.

The second research question *"How can a project-based firm improve its order management and invoicing processes?"* was also covered well with both theory and practice. Based on this research, renewal and streamlining of the order management and invoicing processes is possible also with other than ERP-related improvements. The literature has defined ERP system as a main way to improve order management and invoicing process. However, Valmet Automation already has a great and flexible system, that only requires some minor improvements. Therefore, the main improvement for the challenges is new or updated instructions that include some training in order to implement the new methods and processes. In addition, the process changes include re-categorization of the orders, standardized processes and centralized order management and invoicing.

In order to know what to improve, the current challenges in the processes in Valmet Automation Oy were identified based on the interviews and observation. These main improvements were determined in the current state analysis that listed current challenges in order management and invoicing processes and in general. The main challenges relate to the various order types and exceptions in the processes. These also cause the other significant challenges: inadequate instructions and difficulties with global processes and global supply chain. Actually, the organization has changed its way of working from Finnish project delivery to globally executed projects. This should have caused a lot of changes within the company, but many old working methods still strain the process. Therefore, the improvements do not concern only the order management and invoicing function but also IT and HR functions.

6.2 Theoretical contribution

Based on this thesis, project-based firm has different order management and invoicing processes that cannot be merged together, but all of them have certain common phases. This completes previous literature, that has not defined general order management and invoicing process. This research contributes the literature also by discussing about also other order types than projects within a project-based firm. This study concludes that different order types require special processes. However, there should be some limitation in the number on the order types, in order to streamline the processes. This study introduced 19 different order types and 10 order management and invoicing processes that are executed in Valmet Automation Oy in Finland. Based on the current state analysis the order types could be categorized into three groups: projects, service and product sales. However, the processes themselves vary currently so much that it might be too difficult to merge them into these three groups.

This research supports previous literature by providing a model for general order management and invoicing process to discuss about it as an own process. In the literature, the order management and invoicing process was not found as a defined process or a term. Therefore, the theoretical background is written based on the supply chain management literature. It involves also order management as few steps in order fulfillment process. The theory recognized also projects, products and services as order types within a project-based firm. However, they were not discussed as own processes, because the order management was discussed as a "standard task" for all the order types within the organization. Invoicing, on the other hand, was divided into different types, depending on the sales order type, such as contract, project or recharging.

The current state analysis of the research indicated that the challenges in order management and invoicing processes can be divided into three categories: challenges that concern all processes (process challenges), order type specific challenges (subchallenges) and general challenges that only somehow relate to order management and invoicing. Some of the challenges have been identified in the literature previously, but not related to the order management and invoicing process, because the OMI process have not been discussed previously. In addition, some of the challenges are also typical features of a global business, so they are not automatically bad or problematic themselves. For instance, global processes are really needed in a global business, but a challenge is to manage them efficiently and effectively.

This research complements the previous literature by stating that a project-based organization can improve its order management and invoicing processes also by other changes than ERP-related improvements. The improvements and changes can relate to process, system or organization. The solution proposals for challenges were identified from both the data and the literature. Many improvement proposals were discussed already in the interviews or came up during the observation. The literature introduced ERP system as a main improvement idea for order fulfillment process and also for order management and invoicing process. In addition, coordination with sales and customers was recognized to be an improvement for order management and invoicing process in the literature. This thesis continues the list with a roadmap that includes also the following improvement ideas: updated instructions, improved human resource and information management and process changes.

6.3 Evaluation of the research

Like every research, also this master thesis has some limitations and it might include some little mistakes or misunderstandings. The evaluation of the research is conducted based on the Yin's (2009, p. 41) framework about evaluating the reliability and validity of a case-study research. The validity is improved by using multiple sources in data collection and literature review and by having the script examined by the professor several times during the writing process. However, the topic is not discussed as a term nor a process in

the literature and the theoretical background is gathered together from some "secondary sources". Secondary source in here means that the article or book does not discuss about order management or invoicing as the main subject, but only in few pages or paragraphs, like in supply chain management literature. Therefore, some implications from the theory might be a little debatable.

The validity is also improved by using theory to support the research, like in a single case study generally. The results are compared to the theory in the discussion and the general model of the research is based on the Croxton's (2003) model. The validity has limitations, because there is no theoretical model of order management and invoicing to compare the data and results with in order to complete the pattern matching and explanation building with theory. However, the logic models and common sense are used in the analysis to create a link between challenges and the solutions from the theory. In order to increase the quality of the research, the data analyzing process is discussed in detail in the Chapter 3.

Reliability of the research is improved by using generally approved case study method and collecting the data with semi-structured interviews. However, the interviewees covered only a small portion of the order processors in Valmet Automation. In addition, most of the order types (except main projects) were discussed only with one interviewee. A lot of information was collected also with observation that occurred randomly during the research process in various situations. One of the specialties in the observation were the workshops in the ERP implementation project, that is a unique situation for the company. Therefore, it might be quite difficult to conduct this research similarly and get the same results later.

Generally, a single case study that has some limitations. It is difficult to generalize the results to apply to all project-based firms in all different business environments. In addition, the results might have been distorted, because it is nearly impossible to gather the data objectively from interviews and observation. Some of the interviewees might also have given incorrect or outdated information. The timetable of the research might have also created some mistakes in the process graphs, because they had to be conducted quickly in the beginning of the process, before enough information from the big picture of order management and invoicing in Valmet Automation or in generally in theory. The research was improved by acknowledging these issues, using multiple data sources to triangulate the data and collecting feedback about the process graphs. The process graphs had at least two iteration rounds in order to ensure the quality of the drawings. In addition, the current state analysis has been checked by three Valmeteers and slightly modified based on their feedback.

6.4 Suggestions for further research

The results of current state analysis could be developed further in the future research. In the beginning of this research process, one objective was to design a globally harmonized and uniform order management and invoicing process that includes one set of instructions in standardized ERP interface. However, during the research, the objective turned out to be too ambitious for master thesis, because there was barely any information about the current state of processes even in Finland, much less in other units. Therefore, the company should implement these proposed improvements and the future research should study their impact on order management and invoicing in Valmet Automation Oy.

In addition, the future research should cover the current state of order management and invoicing in the other units, especially the local specialties and requirements. The research could specify why certain sales cases are booked in the units and others to Finland. After that the global and unified framework for all the units could be created based on the improvements of this study and the results of other research. In addition to the global processes, the future research could cover also order management and invoicing as a function. The research could study the different approaches for organizing the order management and invoicing function in a global project-based firm. The study could also evaluate if various order types require differently organized functions.

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APPENDIX A: INTERVIEW QUESTIONS

Basic information

1. What is your name? And what are your responsibilities at Valmet Automation?
2. How does your position (or duties) relate to order management and invoicing?

Order management and invoicing as a term

3. What is [order type]?
4. How do you define order management in [order type]?
5. How do you define invoicing in [order type]?

Order management and invoicing as a process

6. How does the order management and invoicing start and end in [order type]?
    a. What data/information is required for the process (e.g. from sales)?
        i. Who is the customer and where the order is booked?
    b. What is the output of the process? And to which function?
7. What are the different phases in order management process in [order type]?
    a. What are the most critical/challenging phases of the process?
8. How is the invoicing conducted in [order type]?

Order management and invoicing as a function

9. What are the different roles in order management and invoicing process in [order type]?
10. Who / how many employees are processing orders globally in [order type]?
11. Is order management and invoicing process in Finland similar to the global process in [order type]?
    a. Are there differences between the AUT units?

Would like comment on or discuss about something else related to order management and invoicing?

APPENDIX B: SIMPLIFIED ORDER MANAGEMENT & INVOICING PROCESS OF MAIN PROJECTS